2000 On-Road Mobile Source Modeling Emissions Inventories for the Beaumont/Port Arthur Ozone Nonattainment Area

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TO: Anusuya Iyer, Project Manager
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SUBJECT: 2000 On-Road Mobile Source Modeling Emissions Inventories for the Beaumont/Port Arthur Ozone Nonattainment Area
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INTRODUCTION

This Technical Note documents the methods the Texas Transportation Institute (TTI) used to develop the Beaumont/Port Arthur ozone nonattainment area (BPA) August 2000 on-road mobile source modeling emissions inventory estimates. (Documentation of the August 2005 base-case episode forecast, also produced under this task, is provided in a separate Technical Note.)

The three BPA counties are: Hardin, Jefferson, and Orange. The forecast episode analysis days are the four days, August 25, 26, 27 and 30 (a Friday, Saturday, Sunday and Wednesday), a subset of the 11-day, 2000 base-year ozone episode series, Tuesday, August 22 through Friday, September 1.

Emissions of volatile organic compounds (VOC), carbon monoxide (CO), and oxides of nitrogen (NOx), are estimated for each county and day on an hourly basis. The hourly estimates are computed by network links (characterized by 28 facility types, including special intrazonal links) for which the geographical coordinates are provided. Emissions are categorized by 28 vehicle types and 14 pollutant-specific emissions types.

Documented within are the methods related to calculating inventory elements including link-based 2000 vehicle miles traveled (VMT) estimates from the Beaumont/Port Arthur travel demand model (TDM), August day-of-week adjustments and Highway Performance Monitoring

System (HPMS) consistency adjustments to VMT, speeds, VMT mix, MOBILE6 emissions factors, and emissions estimates.

ACKNOWLEDGMENTS
Chris Kite, with the Texas Commission on Environmental Quality (TCEQ), and Martin Boardman and L.D. White, both with TT, contributed to the development of the MOBILE6 emissions factors input data parameter values. Boardman produced the MOBILE6 model set-ups used, and performed the emissions factors analyses. The Texas Department of Transportation (TxDOT) provided the BPA network traffic assignment, intrazonal trips, and zonal radii. Dennis Perkinson, Ph.D., of TTI, developed August day-of-week and HPMS consistency VMT adjustment factors and VMT mix. White processed the VMT and modeled operational speeds. Boardman performed the emissions estimations. Each member of the assigned TTI staff contributed to the quality assurance of the emissions inventory elements. Dr. Perkinson was the principle investigator for this project. This work was performed by TTI under contract to TCEQ. Anusuya Iyer was the TCEQ project technical manager.

Deliverables
Interim deliverables are an informal Technical Note (a narrative in memorandum format that explains the task, the approaches used, and the findings) provided to the Project Manager in WordPerfect 6/7/8 format, and supported by electronic document files. All pertinent data are being submitted in specified electronic format. (There is no FORTRAN source code or executable files developed under this task.) CD-ROM is used to record the final data and supporting documentation. TTI is providing five copies of the final report. One of the copies is an unbound original suitable for copying. Electronic copies of all materials related to the task report to document results and conclusions (e.g., data, work files, text files, etc.), or developed as work products under this contract are provided as requested by the TCEQ staff.

The detailed 2000 emissions inventory data sets are provided on CD-ROM with this technical note. Appendix A lists the CD-ROM volume names and the data set file names and descriptions contained on each CD-ROM.

SUMMARY OF VMT AND EMISSIONS

Table 1 presents a summary of 24-hour BPA network total VMT, average operational speeds, and emissions for each of the four ozone episode analysis days.

Table 1
BPA All Counties August 2000
On-Road Mobile Source VMT, Average Speed (mph), and Emissions (tons per day)

Day	VMT	Speed	VOC	CO	NOx
Friday August 25	13,921,965	38.0	21.89	284.73	49.46
Saturday August 26	11,796,603	38.9	16.78	232.65	32.23
Sunday August 27	10,095,432	39.1	14.77	209.41	22.78
Wednesday August 30	11,963,973	38.6	20.03	258.16	54.07

OVERVIEW OF METHODOLOGY

To develop the BPA ozone episode emissions estimates, a directional link-based, hourly methodology was applied. Emissions estimates were calculated by roadway network link for each hour of each analysis day.

The MOBILE6 model was used to develop hourly emissions factors by MOBILE6 road type (or drive cycle) and 28 vehicle types. Only the speed sensitive freeway and arterial emissions factors were applied — freeway drive cycle emissions factors to freeway links, and arterial drive cycle emissions factors to non-freeway links. The activity basis was the Beaumont/Port Arthur 1997 (validation year) TDM link-based and intrazonal VMT, adjusted to August 2000 day-of-week-specific HPMS VMT control totals. VMT. Automatic traffic recorder (ATR) data were used to produce the seasonal (August) day-of-week VMT adjustment factors, as well as hourly travel fractions to distribute VMT by hour-of-day. Directional split factors were applied to allocate the hourly VMT by peak and off-peak direction. Hourly, directional, average operational speeds (congested speed estimates based on volumes and capacities) were modeled by link. Vehicle classification data were used to estimate time-of-day VMT mixes for apportioning fleetwide link VMT for three road type groups to the 28 U.S. Environmental Protection Agency (EPA) vehicle types. Link-level emissions by vehicle type were calculated by hour. For the geographical allocation of emissions, the link endpoints (designated by network node numbers for which X-Y coordinates are provided) were recorded with the hourly link emissions.

TTI previously developed a series of computer programs to develop detailed on-road mobile source emissions inventories. These computer programs were used to produce and apply the major emissions inventory elements (adjusted operational time-of-day link VMT by vehicle type, operational link-speeds, VMT mix, and MOBILE6 emissions factors) to calculate the emissions estimates. Appendix B describes these programs and their application.

ESTIMATION OF VMT

The outputs of the VMT estimation process are HPMS-consistent estimates of county-level, day-type specific 2000 VMT (and speeds, as discussed in a following section) by hour and direction, for each link of the BPA 1997 TDM network and the added intrazonal links. For this analysis, the day types are Weekday (average Monday through Thursday), Friday, Saturday, and Sunday.

The PREPIN2BW program (for post-processing TDM data for air quality analyses, see Appendix B) was applied to produce the adjusted link-based VMT estimates. This program produced 24 hourly link files for each evaluation year containing the county and road type-indexed ozone season weekday link-data (estimated operational VMT and speeds).

Data Sources

The latest BPA 1997 (model run March 19, 2003), non-directional, user equilibrium traffic assigned network, trip matrices, and zonal radii (assumed intrazonal trip length) were provided by TxDOT. The 1997 TDM was used as the basis for developing the link-based 2000 day-type specific VMT estimates. Because the estimated intrazonal trips are not assigned to the network, the intrazonal trips and zonal radii were needed to estimate the intrazonal VMT.

To adjust and allocate the BPA TDM VMT as needed, two other sources of data were required, ATR data and HPMS VMT estimates.

HPMS VMT estimates are based on traffic count data collected according to a statistical sampling procedure specified by the Federal Highway Administration (FHWA) designed to estimate VMT. A wide range of traffic data is collected under the HPMS program. For the purpose of this study, county total HPMS Annual Average Daily Traffic (AADT) VMT were used to ensure the 1997 travel model VMT was consistent with the HPMS VMT estimates. (EPA and FHWA have endorsed HPMS as the appropriate source of VMT and require that VMT used to construct on-road mobile source emissions inventories be consistent with that reported through HPMS.)

ATR vehicle counts are collected by TxDOT at selected locations on a continuous basis throughout Texas. These counts are available by season, month, and weekday, as well as on an annual average daily basis (i.e., AADT). Since they are continuous, they are especially well suited for making seasonal, day-of-week comparisons (i.e., adjustment factors), even though there may be relatively few ATR data collection locations in any given area. Data from the ATR stations in the BPA were grouped for this analysis. These ATR count data were used to produce the 2000 day-type specific adjustment factors and the time-of-day factors for all of the analysis years.

VMT Adjustments

The 1997 TDM link VMT was adjusted for HPMS consistency and for day-type specification to obtain an estimate of the 2000 VMT. For the 1997 TDM (2000 analysis year), a county-specific control total, consisting of the HPMS AADT VMT for that county and a day-of-week factor, was developed resulting in a total of 12 control totals (three counties and four day types).

2000 Historical Year VMT Adjustment

Since a travel model was not available for 2000, VMT control totals were used to produce the HPMS consistent, day-type specific link-based VMT from the 1997 TDM. The control total consists of the 1997 HPMS AADT VMT for each county and a day-of-week adjustment factor (one factor for each day type Weekday, Friday, Saturday, and Sunday).

The day-of-week adjustment factor was developed using aggregated August ATR data for the years 1999, 2000 and 2001 from stations within the Beaumont/Port Arthur area. This factor was calculated by dividing the day-of-week specific traffic county by the AADT traffic count. One day-of-week factor was developed for all three counties for each day type, resulting in four day-of-week adjustment factors. The day-of-week factors for 2000 are shown in Table 2.

Table 2
BPA 2000 August Day-of-Week Adjustment Factors

Day-of-Week	Adjustment Factor
Weekday	1.03790
Friday	1.20776
Saturday	1.02338
Sunday	0.87580

The HPMS AADT VMT for county was then multiplied by the day-of-week adjustment factor to produce 12 VMT control totals (one for each county for each day type). The BPA 2000 VMT control totals are shown in Table 3.

Table 3
BPA 2000 AADT HPMS VMT and Control Totals

County	AADT HPMS VMT	Weekday	Friday	Saturday	Sunday
Hardin	7,347,784	7,626,265	8,874,359	7,519,575	6,435,189
Jefferson	2,813,461	2,920,091	3,397,986	2,879,240	2,464,029
Orange	1,365,850	1,417,615	1,649,619	1,397,783	1,196,211

The TDM link VMT were then adjusted to be consistent with the control total by multiplying the TDM link VMT by a ratio of the control total VMT (shown above) to the TDM total VMT.

Hourly Travel Factors

The volume and resulting VMT from the 1997 travel demand model in this analysis is a composite 24-hour VMT. To create the hourly VMT from this data, hourly day-type specific factors were used to split the 24-hour VMT into one hour increments, one for each hour of the day. The hourly factors were developed using aggregated BPA August ATR data from the latest available years. This set of factors (24 factors, one for each hour of the day) were then applied to the day-type specific VMT to create the VMT for each hour of the day. The hourly weekday factors and their corresponding hour of the day are shown in Table 4.

Table 4
Hourly VMT Factors

Hour	Weekday	Friday	Saturday	Sunday
6 a.m.	0.047377	0.037808	0.023760	0.016256
7 a.m.	0.063096	0.053202	0.031315	0.020604
8 a.m.	0.052637	0.046384	0.040453	0.027401
9 a.m.	0.048595	0.044916	0.048561	0.039479
10 a.m.	0.051031	0.049226	0.056650	0.049199
11 a.m.	0.055529	0.054633	0.061746	0.056419
12 p.m.	0.058652	0.058149	0.063850	0.067395
1 p.m.	0.059649	0.059511	0.064299	0.072746
2 p.m.	0.061449	0.062029	0.063736	0.073636
3 p.m.	0.069311	0.069530	0.065045	0.075504
4 p.m.	0.075065	0.074235	0.064691	0.074716
5 p.m.	0.078608	0.072726	0.064488	0.075314
6 p.m.	0.057618	0.063041	0.061278	0.068676
7 p.m.	0.043323	0.053352	0.054224	0.056486
8 p.m.	0.036526	0.044367	0.047025	0.046626
9 p.m.	0.030078	0.039497	0.042959	0.037755
10 p.m.	0.021804	0.029639	0.033286	0.027751
11 p.m.	0.016395	0.023146	0.026772	0.020357
12 a.m.	0.011259	0.010726	0.020220	0.024515
1 a.m.	0.008572	0.008198	0.015100	0.018530
2 a.m.	0.007637	0.007355	0.012670	0.015566
3 a.m.	0.007272	0.006876	0.009706	0.010770
4 a.m.	0.012080	0.010454	0.011483	0.011038
5 a.m.	0.026437	0.021000	0.016683	0.013261

Time of Day Directional Split Factors
The 24-hour link assignment volumes, adjusted for ozone season and HPMS consistency and allocated by hour, are nondirectional volumes (i.e., the sum of the volumes in the two directions on a link). Directional splits were applied to estimate the portion of the travel that occurred in each direction. These directional volume estimates were used to estimate the directional speeds (discussed in the next section). Application of the directional split factors resulted in two link records for each network link: one record containing the estimated VMT and speed in the peak (or dominant) direction, and the second record containing the estimated VMT and speed in the opposite direction.

The directional split factors (shown in Appendix C) were developed for application by time-of-day period (see Table 5) at the functional class and area type level.

Table 5
BPA Time-of-Day Travel Periods

Period	Hours
AM Peak	7 a.m. - 8 a.m.
Mid-Day	8 a.m. - 5 p.m.
PM Peak	5 p.m. - 6 p.m.
Overnight	6 p.m. - 7 a.m.

These time-of-day directional splits for each functional class and area type combination were taken from the Technical Note entitled, "1996 Jefferson, Orange, and Hardin Counties Periodic Emission Inventory" (TTI, November 26, 1997). These data were provided by TxDOT's Transportation Planning and Programming Division after collaboration with TxDOT's Beaumont District and the Beaumont/Port Arthur Metropolitan Planning Organization.

ESTIMATION OF LINK SPEEDS
To estimate a links directional, time-of-day congested speed, a speed model involving the estimated freeflow speed for that link and the estimated directional delay for that link is applied. This model is applied to each link, based on the link's county-specific area type and facility type combination, for each time period and each direction. The directional congested speed is computed as follows:

$$Congested\ speed\ ' \frac{60}{\frac{60}{Freeflow\ speed}\%Delay}$$

Freeflow speed factors are used to convert travel demand model speeds (which are by definition level of service [LOS] C) to LOS A speeds (freeflow). The freeflow speed factors used for BPA by county-specific area type/facility type combination are shown in Appendix D.

The second component of the speed model used to calculate the congested speed is the estimated directional delay. The directional delay (in minutes per mile) due to congestion is computed using the following volume/delay equation:

$$Delay = Min\ [A\, e^{B(\frac{V}{C})}, M]$$

Where:

Delay = congestion delay (in minutes/mile);
A & B = volume/delay equation coefficients;
M = maximum minutes of delay per mile; and
V/C = time-of-day directional volume/capacity (v/c) ratio.

The delay model parameters (A, B, and M) were developed for the Dallas/Fort Worth area and verified by application in other Texas urban areas. These are shown in Table 6. The BPA network high capacity facility types are Interstate Highway, Freeway, and Parkway; the remaining facility types (except for centroid connector and intrazonal, which do not use capacity data) are low-capacity facilities.

Table 6
Volume/Delay Equation Parameters

Facility Category	A	B	M
High Capacity Facilities (> 3,400 vehicles per hour [vph], e.g., Interstates and Freeways)	0.015	3.5	5.0
Low Capacity Facilities (≤ 3,400 vph, e.g., Arterials, Collectors and Locals)	0.050	3.0	10.0

The time-of-day directional v/c ratio is estimated using the directional volume (from the VMT estimation) and the time-of-day directional capacity. However, the 24-hour User Equilibrium assignments were performed using nondirectional 24-hour capacities. To estimate the time-of-day directional capacity, the directional split for capacity is assumed at 50-50 and time-of-day (i.e., hourly) capacity factors were applied to the nondirectional capacity for each

link. The hourly capacity factors vary by the time-of-day travel periods listed in Table 5 (i.e, four sets of hourly capacity factors were used). Appendix D summarizes the capacity factors by county-specific area type/facility type combination. Capacity factors (calculated outside of the PREPIN2BW program) are computed as follows:

$$Capacity\ Factor = \frac{(Hourly\ Capacity\ per\ Lane)(Length\ of\ the\ Time\ Period)}{24\text{-}hour\ Capacity\ per\ Lane}$$

Capacity data are not used, however, for the centroid connector links and intrazonal links (intrazonal links are developed specifically for air emissions analyses). The centroid connector traffic assignment input speeds were used as the centroid connector operational speeds estimates. Operational speeds for the intrazonal trips category were estimated by zone as the average of the zone's centroid connector speeds.

The hourly and 24-hour VMT weighted speed summaries by county and road type (network facility type) are provided on CD-ROM (see Appendix A for electronic data descriptions).

BPA VMT Mix

In general VMT mix is estimated using TxDOT 1997 - 2001 vehicle classification data. For the 2000 estimate 1997 - 2000 data were used. The three county area data were aggregated (Hardin, Jefferson and Orange).

TxDOT classification counts classify vehicles into the standard FHWA vehicle classifications (based on vehicle length/number of axles) using best practice vehicle classification count methods.

C	Passenger vehicles;
P	Two-axle, four-tire single-unit trucks;
B	Buses;
SU2	Six-tire, two-axle single-unit vehicles;
SU3	Three-axle single-unit vehicles;
SU4	Four or more axle single-unit vehicles;
SE4	Three or four axle single-trailer vehicles;
SE5	Five-axle single-trailer vehicles;
SE6	Six or more axle single-trailer vehicles;
SD5	Five or less axle multi-trailer vehicles;
SD6	Six-axle multi-trailer vehicles; and
SD7	Seven or more axle multi-trailer vehicles.

EPA and MOBILE use a different vehicle classification scheme than the FHWA categories. The 28 EPA vehicle categories are defined as a function of gross vehicle weight rating (GVWR) and fuel type (see Table 7). The FHWA axle/vehicle length based classification categories must be converted into 28 MOBILE GVWR/fuel type based categories.

The FHWA vehicle classification counts are first aggregated into two intermediate groups.

Passenger Vehicles (PV)	C + P;
Heavy-Duty Vehicles (HDV)	SU2 + SU3 + SU4 + SE4; and
HDDV8b (HDX)	SE5 + SE6 + SD5 + SD6 + SD7.

This is followed by a second intermediate allocation that separates light-duty vehicles (LDV) into passenger cars and light-duty trucks (LDT) based on TxDOT registration data.

LDV	0.652 × PV (by county, 2000 Jefferson registration data shown); and
LDT	0.348 × PV (by county, 2000 Jefferson registration data shown).

A third intermediate allocation further separates LDTs into LDT1 and HLDT. (Note that LDT1 is itself intermediate and is further divided into LDGT1 and LDDT.)

LDT1	0.864 × LDT (by county, 2000 Jefferson registration data shown); and
HLDT	0.136 × LDT (by county, 2000 Jefferson registration data shown).

Next, the remaining FHWA categories are disaggregated into EPA vehicle groups, as shown. Note that TxDOT vehicle classification count procedures do not distinguish between gasoline and diesel LDTs. Consequently, MOBILE defaults for the year of interest are used. As before, actual TxDOT vehicle registration data are used to separate gasoline from diesel heavy-duty trucks. Note also that motorcycles are not counted separately and are included as a default (subtracted from LDGV).

LDGV	0.9977179 × LDV (MOBILE6 default for 2000 shown);
LDDV	0.0022821 × LDV (MOBILE6 default for 2000 shown);
LLDT	0.9944118 × LDT1 (MOBILE6 default for 2000 shown);
LDDT	0.0055882 × LDT1 (MOBILE6 default for 2000 shown);
HDGV	0.354 × HDV (by county, 2000 Jefferson registration data shown);
HDDV	0.646 × HDV (by county, 2000 Jefferson registration data shown); and
MC	0.001 of total (subtracted from LDGV).

This converts the FHWA axle count-based categories into GVWR categories. This part of the conversion procedure is summarized schematically in Table 8. Starting with the TxDOT vehicle classification data, these data themselves provide sufficient information to complete the first step in the conversion process, the allocation of vehicles into passenger vehicles (PV), heavy-duty vehicles (HDV), five axle heavy duty vehicles (HDDV8b), and buses (B). Steps 2 and 3 further allocate these categories using TxDOT registration data. Finally, Step 4 allocates light-duty vehicles by fuel type using EPA MOBILE diesel fractions and motorcycles are separated from light-duty gas vehicles using a nominal constant.

The MOBILE6 28-category typology is a subset of this typology. A combination of EPA MOBILE6 defaults and area vehicle registration data are used to expand these intermediate categories.

For the 28-category EPA scheme, heavy-duty vehicles (HDV)—HDGV and HDDV—are separated into eight and seven categories respectively. HDDV8b vehicle are counted directly. The 15 HDV categories are separated from total HDV, which have been separated by fuel type using TxDOT registration data by county. Each HDV category (HDGV and HDDV) is then divided into sub-categories based on TxDOT area vehicle registration data. Buses are treated separately.

The 28-category EPA scheme also further divides the two LDT categories based in part on assumed loading. The previous LDGT1 and LDGT2 categories (previously defined as GVWR $\leq$ 6,000 and GVWR > 6,000 to 8,500, respectively) are separated into subcategories in terms of adjusted loaded vehicle weight. Adjusted loaded vehicle weight is the average of vehicle curb weight and GVWR. Thus, two new intermediate categories are introduced. These are light light-duty trucks (LLDT) and heavy light-duty trucks (HLDT), which are defined as:

- LLDT - any light-duty truck rated through 6,000 pounds GVWR, and
- HLDT - any light-duty truck rated greater than 6,000 pounds GVWR.

These two new intermediate categories are then used to define the four LDT categories using EPA MOBILE6 defaults for the year of interest. The four LDT categories are:

- LDGT1 - light light-duty trucks through 3,750 pounds loaded vehicle weight (LVW);
- LDGT2 - light light-duty trucks greater than 3,750 pounds LVW;
- LDGT3 - heavy light-duty trucks to 5,750 pounds adjusted loaded vehicle weight (ALVW), and
- LDGT4 - heavy light-duty trucks greater than 5,750 pounds ALVW.

Similarly, the LDDT category is sub-divided into two categories based on GVWR (less than or equal to 6,000 GVWR and 6,000 to 8,500 GVWR). This is accomplished using EPA MOBILE6 default values for the year of interest.

Finally the three bus categories are separated from the TxDOT classification counts bus category using EPA MOBILE6 default values. (Under MOBILE6 the HDV category does not include buses.)

Vehicle classification data is not forecast. For future VMT mix estimates, MOBILE6 default values consistent with the future year are used. For historical VMT mix estimates, the MOBILE6 default values consistent with the historical year are used. No other adjustments are made to alter the count data and conversion procedure to accommodate future years or historical years. Table 9 shows the VMT mix estimation procedure summary followed by explanatory notes. For this analysis, VMT mix estimates were developed for three functional classification groups and four time-of-day periods (AM Peak, 7 a.m. to 8 a.m.; PM Peak 5 p.m. to 6 p.m.; Mid-day, 8 a.m. to 5 p.m.; and Overnight, 8 p.m. to 7 a.m.).

This procedure is performed as described for weekdays. TxDOT vehicle classification data are only collected for weekdays (Monday through Thursday), consequently other data is used to estimate VMT mix for Fridays, Saturdays, and Sundays. The procedure used to estimate Friday, Saturday, and Sunday VMT mix relies on extensive vehicle classification data collected in Texas urban areas over several years. The ratio of weekday VMT mix to Friday, Saturday, and Sunday VMT mix is applied to the weekday VMT mix to produce region specific Friday, Saturday and Sunday VMT mix. (No seasonal changes are assumed.)

Tables 10 through 13 show the BPA 2000 VMT mixes for Weekday, Friday, Saturday and Sunday, respectively.

Table 7
EPA Vehicle Types - 28 Categories

Category	Description	GVWR
LDGV	Light-duty gasoline vehicle	≤ 6,000
LDGT1	Light-duty gasoline truck	≤ 6,000
LDGT2	Light-duty gasoline truck	≤ 6,000
LDGT3	Light-duty gasoline truck	6,001 - 8,500
LDGT4	Light-duty gasoline truck	6,001 - 8,500
HDGV2b	Heavy-duty gasoline vehicle	8,501 - 10,000
HDGV3	Heavy-duty gasoline vehicle	10,001 - 14,000
HDGV4	Heavy-duty gasoline vehicle	14,001 - 16,000
HDGV5	Heavy-duty gasoline vehicle	16,001 - 19,500
HDGV6	Heavy-duty gasoline vehicle	19,501 - 26,000
HDGV7	Heavy-duty gasoline vehicle	26,001 - 33,000
HDGV8a	Heavy-duty gasoline vehicle	33,001 - 60,000
HDGV8b	Heavy-duty gasoline vehicle	> 60,000
HDGB	Heavy-duty gasoline bus	all
LDDV	Light-duty diesel vehicle	≤ 6,000
LDDT12	Light-duty diesel truck	≤ 6,000
LDDT34	Light-duty diesel truck	6,001 - 8,500
HDDV2b	Heavy-duty diesel vehicle	8,501 - 10,000
HDDV3	Heavy-duty diesel vehicle	10,001 - 14,000
HDDV4	Heavy-duty diesel vehicle	14,001 - 16,000
HDDV5	Heavy-duty diesel vehicle	16,001 - 19,500
HDDV6	Heavy-duty diesel vehicle	19,501 - 26,000
HDDV7	Heavy-duty diesel vehicle	26,001 - 33,000
HDDV8a	Heavy-duty diesel vehicle	33,001 - 60,000
HDDV8b	Heavy-duty diesel vehicle	> 60,000
HDDBS	Heavy-duty diesel school bus	all
HDDBT	Heavy-duty diesel transit bus	all
MC	Motorcycle	all

Table 8
Initial Vehicle Classification Conversion Procedure

<table>
<tr><th>Start</th><th>Step 1</th><th>Step 2</th><th>Step 3</th><th>Step 4</th></tr>
<tr><td rowspan="8">Total Vehicles</td><td rowspan="5">PV</td><td rowspan="3">LDV</td><td rowspan="2">LDGV</td><td>MC</td></tr>
<tr><td>LDGV</td></tr>
<tr><td colspan="2">LDDV</td></tr>
<tr><td rowspan="3">LDT</td><td rowspan="2">LDT1</td><td>LLDT</td></tr>
<tr><td>LDDT</td></tr>
<tr><td colspan="2">HLDT</td></tr>
<tr><td rowspan="2">HDV</td><td colspan="3">HDGV</td></tr>
<tr><td colspan="3">HDDV</td></tr>
<tr><td colspan="4">HDDV8b</td></tr>
<tr><td colspan="4">B</td></tr>
</table>

Table 9
VMT Mix Estimation Procedure Summary

EPA-8	EPA-28	Conversion
LDGV	LDGV	.9977 × LDV
LDGT1	LDGT1	.2310 × LLDT
	LDGT2	.7690 × LLDT
LDGT2	LDGT3	.6850 × HLDT
	LDGT4	.3150 × HLDT
HDGV	HDGV2b	.379 × HDGV
	HDGV3	.187 × HDGV
	HDGV4	.080 × HDGV
	HDGV5	.050 × HDGV
	HDGV6	.191 × HDGV
	HDGV7	.052 × HDGV
	HDGV8a	.060 × HDGV
	HDGV8b	.001 × HDGV
	HDGB	.2045 × B
LDDV	LDDV	.0023 × LDV
LDDT	LDDT12	.1623 × LDDT
	LDDT34	.8377 × LDDT
HDDV	HDDV2b	.307 × HDDV
	HDDV3	.123 × HDDV
	HDDV4	.069 × HDDV
	HDDV5	.041 × HDDV
	HDDV6	.162 × HDDV
	HDDV7	.077 × HDDV
	HDDV8a	.221 × HDDV
	HDDV8b	HDX
	HDDBT	.3235 × B
	HDDBS	.4702 × B
MC	MC	MC

Notes to VMT Mix Estimation Procedure Summary

Intermediate category factors and sources:

LDV	.652 × PV (by county, 2000 Jefferson registration data shown)
LDT	.348 × PV (by county, 2000 Jefferson registration data shown)
LDT1	.864 × LDT (by county, 2000 Jefferson registration data shown)
HLDT	.136 × LDT (by county, 2000 Jefferson registration data shown)
LLDT	.9944 × LDT1 (EPA MOBILE6 default)
LDDT	.0056 × LDT1 (EPA MOBILE6 default)
HDV	SU2+SU3+SU4+SE3+SE4
HDX	SE5+SE6+SD5+SD6+SD7
HDGV	.354 × HDV (by county, 2000 Jefferson registration data shown)
HDDV	.646 × HDV (by county, 2000 Jefferson registration data shown)

Category conversion factors and sources:

LDGV	.9977 × LDV (EPA MOBILE6 default, 2000 shown)
LDGT1	.2310 × LLDT (EPA MOBILE6 default, 2000 shown)
LDGT2	.7690 × LLDT (EPA MOBILE6 default, 2000 shown)
LDGT3	.6850 × HLDT (EPA MOBILE6 default, 2000 shown)
LDGT4	.3150 × HLDT (EPA MOBILE6 default, 2000 shown)
HDGV2a	.379 × HDGV (JOHRTS area registration data)
HDGV3	.187 × HDGV (JOHRTS area registration data)
HDGV4	.080 × HDGV (JOHRTS area registration data)
HDGV5	.050 × HDGV (JOHRTS area registration data)
HDGV6	.191 × HDGV (JOHRTS area registration data)
HDGV7	.052 × HDGV (JOHRTS area registration data)
HDGV8a	.060 × HDGV (JOHRTS area registration data)
HDGV8b	.001 × HDGV (JOHRTS area registration data)
HDGB	.2045 × B (EPA MOBILE6 default, 2000 shown)
LDDV	.0023 × LDV (EPA MOBILE6 default, 2000 shown)
LDDT12	.1623 × LDDT (EPA MOBILE6 default, 2000 shown)
LDDT34	.8377 × LDDT (EPA MOBILE6 default, 2000 shown)
HDDV2b	.307 × HDDV (JOHRTS area registration data)
HDDV3	.123 × HDDV (JOHRTS area registration data)
HDDV4	.069 × HDDV (JOHRTS area registration data)
HDDV5	.041 × HDDV (JOHRTS area registration data)
HDDV6	.162 × HDDV (JOHRTS area registration data)
HDDV7	.077 × HDDV (JOHRTS area registration data)
HDDV8a	.221 × HDDV (JOHRTS area registration data)
HDDV8b	HDX (TxDOT classification counts)
HDDBT	.3253 × B (EPA MOBILE6 default, 2000 shown)
HDDBS	.4702 × B (EPA MOBILE6 default, 2000 shown)
MC	MC (default subtracted from LDGV, no conversion)

Table 10
2000 BPA Weekday VMT Mix by Time Period and Roadway Facility Type Group

OBS	TP	FC	P_LDGV	P_LDGT1	P_LDGT2	P_LDGT3	P_LDGT4	P_HDGV2B	P_HDGV_3	P_HDGV_4	P_HDGV_5
1	AM_Peak	Art	0.5479479	0.0715784	0.2382824	0.0335704	0.0154378	0.0061556	0.0030372	0.0012993	0.0008121
2	AM_Peak	Col	0.5065539	0.0855543	0.2848078	0.0429177	0.0197363	0.0042806	0.0021121	0.0009036	0.0005647
3	AM_Peak	Fway	0.5048594	0.0653339	0.2174946	0.0296345	0.0136278	0.0071681	0.0035368	0.0015131	0.0009457
4	Mid_Day	Art	0.5249798	0.0692624	0.2305727	0.0326489	0.0150140	0.0096017	0.0047375	0.0020268	0.0012667
5	Mid_Day	Col	0.4960127	0.0837774	0.2788928	0.0420264	0.0193264	0.0076465	0.0037728	0.0016140	0.0010088
6	Mid_Day	Fway	0.4781483	0.0616509	0.2052343	0.0279810	0.0128674	0.0087733	0.0043288	0.0018519	0.0011574
7	Ovr_Nite	Art	0.5522281	0.0728761	0.2426024	0.0342112	0.0157325	0.0054419	0.0026851	0.0011487	0.0007179
8	Ovr_Nite	Col	0.5127666	0.0866015	0.2882940	0.0434431	0.0199779	0.0050498	0.0024916	0.0010659	0.0006662
9	Ovr_Nite	Fway	0.4380538	0.0568917	0.1893908	0.0257917	0.0118606	0.0064726	0.0031936	0.0013662	0.0008539
10	PM_Peak	Art	0.5635493	0.0736416	0.2451508	0.0346964	0.0159556	0.0059263	0.0029241	0.0012509	0.0007818
11	PM_Peak	Col	0.5103188	0.0861889	0.2869205	0.0432361	0.0198827	0.0059148	0.0029184	0.0012485	0.0007803
12	PM_Peak	Fway	0.5087454	0.0660048	0.2197281	0.0299265	0.0137621	0.0058561	0.0028894	0.0012361	0.0007726

OBS	P_HDGV_6	P_HDGV_7	P_HDGV8A	P_HDGV8B	P_LDDV	P_LDDT12	P_HDDV2B	P_HDDV_3	P_HDDV_4	P_HDDV_5
1	0.0031021	0.0008446	0.0009745	0.0000162	0.0012556	0.0002827	0.0085108	0.0034099	0.0019129	0.0011366
2	0.0021572	0.0005873	0.0006777	0.0000113	0.0011609	0.0003379	0.0052666	0.0021101	0.0011837	0.0007034
3	0.0036124	0.0009835	0.0011348	0.0000189	0.0011571	0.0002580	0.0103113	0.0041312	0.0023175	0.0013771
4	0.0048389	0.0013174	0.0015201	0.0000253	0.0012031	0.0002735	0.0132895	0.0053245	0.0029869	0.0017748
5	0.0038535	0.0010491	0.0012105	0.0000202	0.0011368	0.0003309	0.0094078	0.0037693	0.0021145	0.0012564
6	0.0044214	0.0012037	0.0013889	0.0000231	0.0010960	0.0002435	0.0126451	0.0050663	0.0028421	0.0016888
7	0.0027425	0.0007466	0.0008615	0.0000144	0.0012654	0.0002878	0.0074589	0.0029884	0.0016764	0.0009961
8	0.0025449	0.0006929	0.0007994	0.0000133	0.0011751	0.0003420	0.0062130	0.0024893	0.0013964	0.0008298
9	0.0032619	0.0008881	0.0010247	0.0000171	0.0010043	0.0002247	0.0093164	0.0037326	0.0020939	0.0012442
10	0.0029866	0.0008131	0.0009382	0.0000156	0.0012913	0.0002908	0.0080858	0.0032396	0.0018173	0.0010799
11	0.0029808	0.0008115	0.0009364	0.0000156	0.0011695	0.0003404	0.0072772	0.0029156	0.0016356	0.0009719
12	0.0029512	0.0008035	0.0009271	0.0000155	0.0011660	0.0002607	0.0084421	0.0033824	0.0018974	0.0011275

OBS	P_HDDV_6	P_HDDV_7	P_HDDV8A	P_HDDV8B	P_MC	P_HDGB	P_HDDBT	P_HDDBS	P_LDDT34
1	0.0044911	0.0021346	0.0061267	0.0350742	0.0010000	0.0020750	0.0033013	0.0047715	0.0014586
2	0.0027791	0.0013209	0.0037913	0.0099573	0.0010000	0.0036358	0.0057845	0.0083606	0.0017434
3	0.0054411	0.0025862	0.0074228	0.1079484	0.0010000	0.0009926	0.0015792	0.0022826	0.0013314
4	0.0070127	0.0033332	0.0095667	0.0507599	0.0010000	0.0008693	0.0013831	0.0019990	0.0014114
5	0.0049644	0.0023596	0.0067724	0.0195487	0.0010000	0.0011084	0.0017635	0.0025489	0.0017072
6	0.0066726	0.0031716	0.0091028	0.1426250	0.0010000	0.0007279	0.0011580	0.0016738	0.0012563
7	0.0039360	0.0018708	0.0053694	0.0370820	0.0010000	0.0005265	0.0008376	0.0012107	0.0014851
8	0.0032785	0.0015583	0.0044726	0.0096031	0.0010000	0.0003006	0.0004782	0.0006911	0.0017647
9	0.0049161	0.0023367	0.0067066	0.2221996	0.0010000	0.0010222	0.0016264	0.0023507	0.0011593
10	0.0042667	0.0020280	0.0058207	0.0190491	0.0010000	0.0003885	0.0006180	0.0008933	0.0015007
11	0.0038401	0.0018252	0.0052387	0.0098761	0.0010000	0.0000000	0.0000000	0.0000000	0.0017563
12	0.0044548	0.0021174	0.0060772	0.1126364	0.0010000	0.0005061	0.0008051	0.0011637	0.0013450

Table 11
2000 BPA Friday VMT Mix by Time Period and Roadway Facility Type Group

OBS	TP	FC	P_LDGV	P_LDGT1	P_LDGT2	P_LDGT3	P_LDGT4	P_HDGV2B	P_HDGV_3	P_HDGV_4	P_HDGV_5
1	AM_Peak	Art	0.6011069	0.0669581	0.2229018	0.0316560	0.0145574	0.0035718	0.0017623	0.0007539	0.0004712
2	AM_Peak	Col	0.5544951	0.0798581	0.2658454	0.0403824	0.0185704	0.0024784	0.0012229	0.0005231	0.0003270
3	AM_Peak	Fway	0.5690200	0.0627881	0.2090200	0.0287088	0.0132021	0.0042731	0.0021083	0.0009020	0.0005637
4	Mid_Day	Art	0.5836989	0.0656659	0.2186001	0.0312024	0.0143489	0.0056466	0.0027860	0.0011919	0.0007449
5	Mid_Day	Col	0.5469808	0.0787778	0.2622493	0.0398362	0.0183192	0.0044600	0.0022006	0.0009414	0.0005884
6	Mid_Day	Fway	0.5481098	0.0602571	0.2005941	0.0275683	0.0126776	0.0053189	0.0026244	0.0011227	0.0007017
7	Ovr_Nite	Art	0.6034924	0.0679126	0.2260793	0.0321375	0.0147788	0.0031457	0.0015521	0.0006640	0.0004150
8	Ovr_Nite	Col	0.5590076	0.0805068	0.2680050	0.0407105	0.0187212	0.0029119	0.0014367	0.0006147	0.0003842
9	Ovr_Nite	Fway	0.5141710	0.0569327	0.1895272	0.0260178	0.0119646	0.0040177	0.0019824	0.0008481	0.0005300
10	PM_Peak	Art	0.6124071	0.0682416	0.2271744	0.0324107	0.0149045	0.0034065	0.0016808	0.0007190	0.0004494
11	PM_Peak	Col	0.5573154	0.0802635	0.2671951	0.0405874	0.0186647	0.0034166	0.0016858	0.0007212	0.0004507
12	PM_Peak	Fway	0.5717068	0.0632461	0.2105444	0.0289063	0.0132929	0.0034807	0.0017174	0.0007347	0.0004592

OBS	P_HDGV_6	P_HDGV_7	P_HDGV8A	P_HDGV8B	P_LDDV	P_LDDT12	P_HDDV2B	P_HDDV_3	P_HDDV_4	P_HDDV_5
1	0.0018000	0.0004901	0.0005655	0.0000094	0.0013731	0.0002649	0.0057868	0.0023185	0.0013006	0.0007728
2	0.0012490	0.0003400	0.0003924	0.0000065	0.0012668	0.0003159	0.0035732	0.0014316	0.0008031	0.0004772
3	0.0021534	0.0005863	0.0006765	0.0000113	0.0013000	0.0002484	0.0072028	0.0028858	0.0016189	0.0009619
4	0.0028456	0.0007747	0.0008939	0.0000149	0.0013334	0.0002597	0.0091580	0.0036692	0.0020583	0.0012231
5	0.0022476	0.0006119	0.0007061	0.0000118	0.0012497	0.0003116	0.0064300	0.0025762	0.0014452	0.0008587
6	0.0026805	0.0007298	0.0008420	0.0000140	0.0012523	0.0002383	0.0089833	0.0035992	0.0020191	0.0011997
7	0.0015853	0.0004316	0.0004980	0.0000083	0.0013786	0.0002686	0.0050523	0.0020242	0.0011355	0.0006747
8	0.0014675	0.0003995	0.0004610	0.0000077	0.0012771	0.0003184	0.0041981	0.0016820	0.0009436	0.0005607
9	0.0020248	0.0005512	0.0006361	0.0000106	0.0011749	0.0002252	0.0067765	0.0027150	0.0015231	0.0009050
10	0.0017167	0.0004674	0.0005393	0.0000090	0.0013989	0.0002699	0.0054462	0.0021820	0.0012241	0.0007273
11	0.0017218	0.0004688	0.0005409	0.0000090	0.0012733	0.0003175	0.0049258	0.0019735	0.0011071	0.0006578
12	0.0017541	0.0004776	0.0005510	0.0000092	0.0013061	0.0002502	0.0058797	0.0023557	0.0013215	0.0007852

OBS	P_HDDV_6	P_HDDV_7	P_HDDV8A	P_HDDV8B	P_MC	P_HDGB	P_HDDBT	P_HDDBS	P_LDDT34
1	0.0030536	0.0014514	0.0041658	0.0238482	0.0010000	0.0012040	0.0022447	0.0032443	0.0013666
2	0.0018855	0.0008962	0.0025722	0.0067557	0.0010000	0.0021051	0.0039245	0.0056724	0.0016299
3	0.0038008	0.0018066	0.0051851	0.0754055	0.0010000	0.0005917	0.0011032	0.0015944	0.0012815
4	0.0048326	0.0022970	0.0065926	0.0349793	0.0010000	0.0005112	0.0009531	0.0013775	0.0013402
5	0.0033931	0.0016127	0.0046288	0.0133611	0.0010000	0.0006465	0.0012053	0.0017421	0.0016079
6	0.0047404	0.0022531	0.0064668	0.1013238	0.0010000	0.0004413	0.0008227	0.0011891	0.0012298
7	0.0026660	0.0012672	0.0036370	0.0251175	0.0010000	0.0003043	0.0005674	0.0008200	0.0013861
8	0.0022153	0.0010530	0.0030221	0.0064888	0.0010000	0.0001733	0.0003231	0.0004670	0.0016431
9	0.0035759	0.0016996	0.0048782	0.1616231	0.0010000	0.0006345	0.0011830	0.0017098	0.0011620
10	0.0028739	0.0013660	0.0039206	0.0128306	0.0010000	0.0002233	0.0004163	0.0006017	0.0013928
11	0.0025993	0.0012355	0.0035460	0.0066850	0.0010000	0.0000000	0.0000000	0.0000000	0.0016382
12	0.0031027	0.0014747	0.0042326	0.0784484	0.0010000	0.0003008	0.0005607	0.0008105	0.0012909

Table 12
2000 BPA Saturday VMT Mix by Time Period and Roadway Facility Type Group

OBS	TP	FC	P_LDGV	P_LDGT1	P_LDGT2	P_LDGT3	P_LDGT4	P_HDGV2B	P_HDGV_3	P_HDGV_4	P_HDGV_5
1	AM_Peak	Art	0.6279878	0.0664259	0.2211299	0.0294900	0.0135614	0.0022687	0.0011194	0.0004789	0.0002993
2	AM_Peak	Col	0.5765873	0.0788536	0.2625016	0.0374437	0.0172190	0.0015669	0.0007731	0.0003307	0.0002067
3	AM_Peak	Fway	0.6071950	0.0636203	0.2117903	0.0273160	0.0125616	0.0027722	0.0013678	0.0005852	0.0003657
4	Mid_Day	Art	0.6155670	0.0657587	0.2189091	0.0293418	0.0134932	0.0036204	0.0017863	0.0007642	0.0004776
5	Mid_Day	Col	0.5716234	0.0781760	0.2602456	0.0371219	0.0170710	0.0028338	0.0013982	0.0005982	0.0003738
6	Mid_Day	Fway	0.5927740	0.0618779	0.2059897	0.0265840	0.0122250	0.0034971	0.0017255	0.0007382	0.0004614
7	Ovr_Nite	Art	0.6287979	0.0671934	0.2236848	0.0298587	0.0137309	0.0019927	0.0009832	0.0004206	0.0002629
8	Ovr_Nite	Col	0.5795446	0.0792574	0.2638456	0.0376354	0.0173072	0.0018355	0.0009056	0.0003874	0.0002421
9	Ovr_Nite	Fway	0.5677115	0.0596853	0.1986907	0.0256130	0.0117785	0.0026968	0.0013306	0.0005692	0.0003558
10	PM_Peak	Art	0.6353640	0.0672313	0.2238111	0.0299844	0.0137887	0.0021488	0.0010602	0.0004536	0.0002835
11	PM_Peak	Col	0.5784376	0.0791063	0.2633426	0.0375637	0.0172742	0.0021560	0.0010638	0.0004551	0.0002844
12	PM_Peak	Fway	0.6088785	0.0639602	0.2129217	0.0274506	0.0126235	0.0022537	0.0011120	0.0004757	0.0002973

OBS	P_HDGV_6	P_HDGV_7	P_HDGV8A	P_HDGV8B	P_LDDV	P_LDDT12	P_HDDV2B	P_HDDV_3	P_HDDV_4	P_HDDV_5
1	0.0011433	0.0003113	0.0003592	0.0000060	0.0014361	0.0002620	0.0036753	0.0014725	0.0008260	0.0004908
2	0.0007896	0.0002150	0.0002481	0.0000041	0.0013187	0.0003110	0.0022588	0.0009050	0.0005077	0.0003017
3	0.0013971	0.0003803	0.0004389	0.0000073	0.0013886	0.0002509	0.0046724	0.0018720	0.0010501	0.0006240
4	0.0018245	0.0004967	0.0005732	0.0000096	0.0014077	0.0002594	0.0058713	0.0023523	0.0013196	0.0007841
5	0.0014281	0.0003888	0.0004486	0.0000075	0.0013074	0.0003084	0.0040851	0.0016367	0.0009181	0.0005456
6	0.0017624	0.0004798	0.0005536	0.0000092	0.0013557	0.0002441	0.0059059	0.0023662	0.0013274	0.0007887
7	0.0010043	0.0002734	0.0003155	0.0000053	0.0014379	0.0002650	0.0032002	0.0012822	0.0007193	0.0004274
8	0.0009250	0.0002518	0.0002906	0.0000048	0.0013255	0.0003126	0.0026460	0.0010601	0.0005947	0.0003534
9	0.0013591	0.0003700	0.0004269	0.0000071	0.0012985	0.0002354	0.0045481	0.0018222	0.0010222	0.0006074
10	0.0010829	0.0002948	0.0003402	0.0000057	0.0014529	0.0002652	0.0034351	0.0013763	0.0007721	0.0004588
11	0.0010865	0.0002958	0.0003413	0.0000057	0.0013229	0.0003120	0.0031081	0.0012453	0.0006986	0.0004151
12	0.0011358	0.0003092	0.0003568	0.0000059	0.0013924	0.0002523	0.0038067	0.0015252	0.0008556	0.0005084

OBS	P_HDDV_6	P_HDDV_7	P_HDDV8A	P_HDDV8B	P_MC	P_HDGB	P_HDDBT	P_HDDBS	P_LDDT34
1	0.0019394	0.0009218	0.0026457	0.0151464	0.0010000	0.0007648	0.0014256	0.0020605	0.0013519
2	0.0011919	0.0005665	0.0016260	0.0042706	0.0010000	0.0013309	0.0024809	0.0035858	0.0016048
3	0.0024655	0.0011719	0.0033635	0.0489148	0.0010000	0.0003839	0.0007156	0.0010343	0.0012948
4	0.0030982	0.0014726	0.0042266	0.0224256	0.0010000	0.0003278	0.0006110	0.0008832	0.0013383
5	0.0021557	0.0010246	0.0029407	0.0084885	0.0010000	0.0004108	0.0007657	0.0011068	0.0015910
6	0.0031165	0.0014813	0.0042515	0.0666129	0.0010000	0.0002901	0.0005409	0.0007817	0.0012593
7	0.0016887	0.0008027	0.0023038	0.0159100	0.0010000	0.0001928	0.0003594	0.0005194	0.0013675
8	0.0013962	0.0006636	0.0019048	0.0040897	0.0010000	0.0001092	0.0002036	0.0002943	0.0016130
9	0.0024000	0.0011407	0.0032741	0.1084747	0.0010000	0.0004259	0.0007940	0.0011476	0.0012147
10	0.0018126	0.0008616	0.0024728	0.0080926	0.0010000	0.0001408	0.0002626	0.0003795	0.0013683
11	0.0016401	0.0007795	0.0022374	0.0042180	0.0010000	0.0000000	0.0000000	0.0000000	0.0016100
12	0.0020088	0.0009548	0.0027404	0.0507902	0.0010000	0.0001948	0.0003630	0.0005247	0.0013017

Table 13
2000 BPA Sunday VMT Mix by Time Period and Roadway Facility Type Group

OBS	TP	FC	P_LDGV	P_LDGT1	P_LDGT2	P_LDGT3	P_LDGT4	P_HDGV2B	P_HDGV_3	P_HDGV_4	P_HDGV_5
1	AM_Peak	Art	0.5843107	0.0780822	0.2599335	0.0332675	0.0152985	0.0015109	0.0007455	0.0003189	0.0001993
2	AM_Peak	Col	0.5263035	0.0909359	0.3027230	0.0414404	0.0190569	0.0010237	0.0005051	0.0002161	0.0001351
3	AM_Peak	Fway	0.5725337	0.0757848	0.2522857	0.0312273	0.0143603	0.0018708	0.0009231	0.0003949	0.0002468
4	Mid_Day	Art	0.5755622	0.0776765	0.2585830	0.0332624	0.0152962	0.0024228	0.0011954	0.0005114	0.0003196
5	Mid_Day	Col	0.5233337	0.0904237	0.3010181	0.0412070	0.0189496	0.0018570	0.0009162	0.0003920	0.0002450
6	Mid_Day	Fway	0.5636162	0.0743255	0.2474276	0.0306447	0.0140923	0.0023798	0.0011742	0.0005023	0.0003140
7	Ovr_Nite	Art	0.5837980	0.0788137	0.2623685	0.0336107	0.0154563	0.0013242	0.0006534	0.0002795	0.0001747
8	Ovr_Nite	Col	0.5280644	0.0912395	0.3037339	0.0415788	0.0191205	0.0011971	0.0005906	0.0002527	0.0001579
9	Ovr_Nite	Fway	0.5465904	0.0725942	0.2416640	0.0298969	0.0137485	0.0018583	0.0009169	0.0003923	0.0002452
10	PM_Peak	Art	0.5887710	0.0787081	0.2620172	0.0336879	0.0154918	0.0014252	0.0007032	0.0003008	0.0001880
11	PM_Peak	Col	0.5274060	0.0911260	0.3033560	0.0415270	0.0190968	0.0014071	0.0006943	0.0002970	0.0001856
12	PM_Peak	Fway	0.5733698	0.0760902	0.2533021	0.0313402	0.0144122	0.0015190	0.0007495	0.0003206	0.0002004

OBS	P_HDGV_6	P_HDGV_7	P_HDGV8A	P_HDGV8B	P_LDDV	P_LDDT12	P_HDDV2B	P_HDDV_3	P_HDDV_4	P_HDDV_5
1	0.0007614	0.0002073	0.0002392	0.0000040	0.0013389	0.0003069	0.0024478	0.0009807	0.0005501	0.0003269
2	0.0005159	0.0001405	0.0001621	0.0000027	0.0012062	0.0003574	0.0014759	0.0005913	0.0003317	0.0001971
3	0.0009428	0.0002567	0.0002962	0.0000049	0.0013119	0.0002979	0.0031534	0.0012634	0.0007088	0.0004211
4	0.0012210	0.0003324	0.0003836	0.0000064	0.0013189	0.0003053	0.0039294	0.0015743	0.0008832	0.0005248
5	0.0009358	0.0002548	0.0002940	0.0000049	0.0011994	0.0003554	0.0026771	0.0010726	0.0006017	0.0003575
6	0.0011993	0.0003265	0.0003768	0.0000063	0.0012915	0.0002921	0.0040193	0.0016103	0.0009034	0.0005368
7	0.0006673	0.0001817	0.0002096	0.0000035	0.0013377	0.0003098	0.0021268	0.0008521	0.0004780	0.0002840
8	0.0006033	0.0001642	0.0001895	0.0000032	0.0012102	0.0003586	0.0017258	0.0006914	0.0003879	0.0002305
9	0.0009365	0.0002550	0.0002942	0.0000049	0.0012526	0.0002853	0.0031342	0.0012557	0.0007044	0.0004186
10	0.0007182	0.0001955	0.0002256	0.0000038	0.0013491	0.0003094	0.0022785	0.0009129	0.0005121	0.0003043
11	0.0007091	0.0001931	0.0002228	0.0000037	0.0012087	0.0003582	0.0020285	0.0008127	0.0004559	0.0002709
12	0.0007655	0.0002084	0.0002405	0.0000040	0.0013139	0.0002991	0.0025659	0.0010280	0.0005767	0.0003427

OBS	P_HDDV_6	P_HDDV_7	P_HDDV8A	P_HDDV8B	P_MC	P_HDGB	P_HDDBT	P_HDDBS	P_LDDT34
1	0.0012917	0.0006139	0.0017621	0.0100875	0.0010000	0.0005093	0.0009495	0.0013723	0.0015836
2	0.0007788	0.0003702	0.0010624	0.0027904	0.0010000	0.0008695	0.0016210	0.0023429	0.0018443
3	0.0016640	0.0007909	0.0022701	0.0330132	0.0010000	0.0002591	0.0004830	0.0006981	0.0015370
4	0.0020735	0.0009856	0.0028287	0.0150086	0.0010000	0.0002194	0.0004089	0.0005911	0.0015754
5	0.0014127	0.0006715	0.0019272	0.0055629	0.0010000	0.0002692	0.0005018	0.0007253	0.0018339
6	0.0021209	0.0010081	0.0028934	0.0453337	0.0010000	0.0001974	0.0003681	0.0005320	0.0015074
7	0.0011223	0.0005334	0.0015310	0.0105732	0.0010000	0.0001281	0.0002388	0.0003452	0.0015984
8	0.0009107	0.0004329	0.0012423	0.0026675	0.0010000	0.0000712	0.0001328	0.0001920	0.0018505
9	0.0016539	0.0007861	0.0022562	0.0747522	0.0010000	0.0002935	0.0005471	0.0007908	0.0014723
10	0.0012023	0.0005715	0.0016402	0.0053678	0.0010000	0.0000934	0.0001742	0.0002517	0.0015963
11	0.0010704	0.0005088	0.0014603	0.0027530	0.0010000	0.0000000	0.0000000	0.0000000	0.0018482
12	0.0013540	0.0006436	0.0018471	0.0342341	0.0010000	0.0001313	0.0002447	0.0003537	0.0015432

ESTIMATION OF EMISSIONS FACTORS

The MOBILE6 model (October 2002) was applied to calculate the episode day emissions factors (in grams per mile [g/mi]) of VOC, CO, and NOx. Emissions factors are estimated by speed, emissions type (i.e., emissions factor sub-component), hour, MOBILE6 road type (or drive cycle), and vehicle type for the three-county BPA ozone nonattainment area. The average "vehicle type" emissions factors for each vehicle class fleet (28) are developed by combining the MOBILE6 by-model-year emissions factors output weighted by their corresponding model year travel fractions. The emissions factors are organized in the form of "look-up" tables. No emissions factor post-processing was required.

The MOBILE6 model is equipped with national (or EPA) default modeling values for a wide range of conditions that affect emissions factors. In fact, the only actual data parameters requiring user-input values to run the model are fuel Reid Vapor Pressure (RVP), temperature, and calendar year. Many MOBILE6 default modeling parameters may be overridden through the use of MOBILE6 commands and their associated inputs and options. For this analysis, particular MOBILE6 defaults were replaced by local input values that were developed to yield emissions factors characteristic of the August 2000 episode day climatic conditions, and evaluation-specific vehicle fleets, activity, and emissions control programs.

The following emissions factors documentation discusses the MOBILE6 input/output files, summarizes the control programs modeled, details the aggregation-level of the applied MOBILE6 emissions factors, and briefly describes all of the MOBILE6 commands that may affect emissions factor calculations. It also identifies the commands that were applied, explains the development of the locality-specific inputs, and describes the emissions factor post-processing procedure.

MOBILE6 Input and Output Files

The MOBILE6 commands and particular model input data are entered in the MOBILE6 command file. Other input parameters (and in some cases, commands) are applied to MOBILE6 from external data files.

The POLFAC6 program (described in Appendix B) was applied to run MOBILE6 with the user-input command and external data files to produce VOC, CO, and NOx emissions factor output tables. (RATEADJV6 was applied to POLFAC6 output where post-processing of emissions factors was required, discussed later.) The final product of the emissions factor modeling is 12 emissions factor files (i.e., one table of hourly emissions factors for each county for each day). (A corresponding set of average 24-hour emissions factors was also produced for quality assurance purposes.)

All of the MOBILE6 input files and output files (MOBILE6 emissions factor tables developed with POLFAC6 and RATEADJV6) are provided on CD-ROM. The CD-ROM volume names and MOBILE6 input and output file names are listed in Appendix A.

Control Programs Modeled
All federal motor vehicle control programs were modeled (this is the MOBILE6 default). Also modeled were the federal programs to offset heavy-duty diesel (HDDV) defeat device effects—the low emissions rebuild program, and the HDDV 2004 standard pull-ahead program (this is the MOBILE6 default).

Aggregation Level of MOBILE6 Emissions Factors
The by-model-year emissions factors from the MOBILE6 database output format are condensed into average fleet emissions factors by vehicle class. This is performed by weighting (multiplying) each by-model-year emissions factor by its corresponding travel fraction and summing the resulting products. Each emissions factor table provides the MOBILE6 emissions factors by:

- 28 vehicle types,
- 4 road types,
- 14 speeds (except for two MOBILE6 road types, each with one average speed),
- 15 pollutant-specific emissions types, and
- 24 hourly time periods.

MOBILE6 vehicle type, emissions type (pertaining to VOC, CO, and NOx pollutants only), and roadway type classifications are described in Tables 14 through 16. Tables 17 and 18 show the speeds and the sequence for hourly time periods, respectively.

The 28 MOBILE6 vehicle types as defined by fuel-type (gasoline or diesel) and GVWR category, are shown in sequence by EPA vehicle type number in Table 14.

Table 14
Complete MOBILE6 Vehicle Classifications

Number	Abbreviation	Description
1	LDGV	Light-Duty Gasoline Vehicles (Passenger Cars)
2	LDGT1	Light-Duty Gasoline Trucks 1 (0-6,000 lbs. GVWR, 0-3,750 lbs. LVW)
3	LDGT2	Light-Duty Gasoline Trucks 2 (0-6,000 lbs. GVWR, 3,751-5,750 lbs. LVW)
4	LDGT3	Light-Duty Gasoline Trucks 3 (6,001-8,500 lbs. GVWR, 0-5,750 lbs. ALVW*)
5	LDGT4	Light-Duty Gasoline Trucks 4 (6,001-8,500 lbs. GVWR, 5,751 lbs. and greater ALVW)
6	HDGV2b	Class 2b Heavy-Duty Gasoline Vehicles (8,501-10,000 lbs. GVWR)
7	HDGV3	Class 3 Heavy-Duty Gasoline Vehicles (10,001-14,000 lbs. GVWR)
8	HDGV4	Class 4 Heavy-Duty Gasoline Vehicles (14,001-16,000 lbs. GVWR)
9	HDGV5	Class 5 Heavy-Duty Gasoline Vehicles (16,001-19,500 lbs. GVWR)
10	HDGV6	Class 6 Heavy-Duty Gasoline Vehicles (19,501-26,000 lbs. GVWR)
11	HDGV7	Class 7 Heavy-Duty Gasoline Vehicles (26,001-33,000 lbs. GVWR)
12	HDGV8a	Class 8a Heavy-Duty Gasoline Vehicles (33,001-60,000 lbs. GVWR)
13	HDGV8b	Class 8b Heavy-Duty Gasoline Vehicles (>60,000 lbs. GVWR)
14	LDDV	Light-Duty Diesel Vehicles (Passenger Cars)
15	LDDT12	Light-Duty Diesel Trucks 1 and 2 (0-6,000 lbs. GVWR)
16	HDDV2b	Class 2b Heavy-Duty Diesel Vehicles (8,501-10,000 lbs. GVWR)
17	HDDV3	Class 3 Heavy-Duty Diesel Vehicles (10,001-14,000 lbs. GVWR)
18	HDDV4	Class 4 Heavy-Duty Diesel Vehicles (14,001-16,000 lbs. GVWR)
19	HDDV5	Class 5 Heavy-Duty Diesel Vehicles (16,001-19,500 lbs. GVWR)
20	HDDV6	Class 6 Heavy-Duty Diesel Vehicles (19,501-26,000 lbs. GVWR)
21	HDDV7	Class 7 Heavy-Duty Diesel Vehicles (26,001-33,000 lbs. GVWR)
22	HDDV8a	Class 8a Heavy-Duty Diesel Vehicles (33,001-60,000 lbs. GVWR)
23	HDDV8b	Class 8b Heavy-Duty Diesel Vehicles (>60,000 lbs. GVWR)
24	MC	Motorcycles (Gasoline)
25	HDGB	Gasoline Buses (School, Transit, and Urban)
26	HDDBT	Diesel Transit and Urban Buses
27	HDDBS	Diesel School Buses
28	LDDT34	Light-Duty Diesel Trucks 3 and 4 (6,001-8,500 lbs. GVWR)

* The adjusted loaded vehicle weight is the numerical average of the vehicle curb weight and the (GVWR).
Source: MOBILE6 User's Guide (EPA, January 2002).

The eight MOBILE6 emissions type classifications (excludes the non-pertinent pollutants, e.g., particulates and toxics) are shown in Table 15. Expanding these emissions types by individual pollutant yields 12 pollutant-specific emissions types. In addition to these 12 pollutant-specific emissions types shown in Table 15, POLFAC62 emissions factor tables contain the three composite emissions factors (i.e., one for each pollutant). Thus, POLFAC62 calculates MOBILE6 emissions factors for up to 15 pollutant-specific emissions types. For this analysis, MOBILE6 emissions factors were calculated for all of the 15 pollutant-specific emissions types except for refueling emissions, which are classified as an area source emissions category.

Table 15
MOBILE6 Emission Type Classifications

Number	Abbreviation	Description	Pollutants	Vehicle Classes
1	Running	Exhaust Running Emissions	Hydrocarbon (HC), CO, NOx	All
2	Start	Exhaust Engine Start Emissions (trip start)	HC, CO, NOx	LD plus MC
3	Hot Soak	Evaporative Hot Soak Emissions (trip end)	HC	Gas, including MC
4	Diurnal	Evaporative Diurnal Emissions (heat rise)	HC	Gas, including MC
5	Resting	Evaporative Resting Loss Emissions (leaks and seepage)	HC	Gas, including MC
6	Run Loss	Evaporative Running Loss Emissions	HC	Gas, less MC
7	Crankcase	Evaporative Crankcase Emissions (blow-by)	HC	Gas, including MC
8	Refueling	Evaporative Refueling Emissions (fuel displacement and spillage)	HC	Gas, less MC

Source: MOBILE6 User's Guide (EPA, January 2002).

MOBILE6 calculates emissions factors reflective of driving cycles observed on four roadway types, as well as emissions factors for those emissions types that are not directly applicable to the driving cycles. The driving cycle (or roadway type) descriptions are provided in Table 16. The fifth roadway type, according to MOBILE6 is "None." None, or roadway type number 5, is the index for the emissions types that do not apply to the driving cycles, and thus are not sensitive to, or do not vary by, roadway type or speed.

The POLFAC62 emissions factor table, however, categorizes all of the pollutant-specific emissions types by MOBILE6 roadway types one through four—Freeway, Arterial, Local, and Ramp. That is, in POLFAC62 tables, the MOBILE6 g/mi emissions factors corresponding to the "None" roadway type are tabulated as emissions factors under each of the four actual roadway

types. This allocation of the MOBILE6 "None" road type emissions factors to the Freeway, Arterial, Local, and Ramp MOBILE6 road types is done in POLFAC62 so that all emissions, regardless of "type," may be spatially allocated to the functional class (or roadway type)-coded network links.

Table 16
MOBILE6 Roadway Classifications

Number	Abbreviation	Description
1	Freeway	High-Speed, Limited-Access Roadways
2	Arterial	Arterial and Collector Roadways
3	Local	Urban Local Roadways
4	Fwy Ramp	Freeway on and off ramps
5	None	Not Applicable (For start and some evaporative emissions)

Source: MOBILE6 User's Guide (EPA, January 2002).

The 14 speeds for which the MOBILE6 freeway and arterial emissions factors are calculated and tabulated are presented in Table 17. Later in the emissions estimation process, emissions factors for average operational speeds that are not represented in the 14 speeds as tabulated, are calculated by interpolation (except for those speeds higher than the MOBILE6 maximum speed, and those lower than the MOBILE6 minimum speed, in which case the emissions factors corresponding to these bounding speeds are used, respectively). The MOBILE6 Local and Ramp road type emissions factors are not speed sensitive and are each characterized by one average speed.

Table 17
Speeds for POLFAC62 Tabulated MOBILE6 Freeway and Arterial Emissions Factors*

Number	Speed
1	2.5 mph
2	5 mph
3	10 mph
4	15 mph
5	20 mph
6	25 mph
7	30 mph
8	35 mph
9	40 mph
10	45 mph
11	50 mph
12	55 mph
13	60 mph
14	65 mph

* The MOBILE6 Local and Ramp drive cycle emissions factor's fixed speeds are 12.9 and 34.6 mph, respectively.

MOBILE6 uses several hourly input parameters (e.g., hourly temperatures, hourly VMT fractions, etc.) to model hourly emissions factors. MOBILE6 requires that hourly input parameters be sequenced starting from the 6 a.m. hour. In some cases, however, particular overnight hours are grouped together as a single time period. Table 18 shows the MOBILE6 sequence for hourly inputs.

Table 18
General Sequence for Calendar Day Hourly* Inputs to MOBILE6

Input Sequence Number	Abbreviation	Description
1	6 a.m.	6 a.m. through 6:59 a.m.
2	7 a.m.	7 a.m. through 7:59 a.m.
3	8 a.m	8 a.m. through 8:59 a.m.
4	9 a.m.	9 a.m. through 9:59 a.m.
5	10 a.m.	10 a.m. through 10:59 a.m.
6	11 a.m.	11 a.m. through 11:59 a.m.
7	12 Noon	12 p.m. through 12:59 p.m.
8	1 p.m.	1 p.m. through 1:59 p.m.
9	2 p.m.	2 p.m. through 2:59 p.m.
10	3 p.m.	3 p.m. through 3:59 p.m.
11	4 p.m.	4 p.m. through 4:59 p.m.
12	5 p.m.	5 p.m. through 5:59 p.m.
13	6 p.m.	6 p.m. through 6:59 p.m.
14	7 p.m.	7 p.m. through 7:59 p.m.
15	8 p.m.	8 p.m. through 8:59 p.m.
16	9 p.m.	9 p.m. through 9:59 p.m.
17	10 p.m.	10 p.m. through 10:59 p.m.
18	11 p.m.	11 p.m. through 11:59 p.m.
19	12 Midnight	12 a.m. through 12:59 a.m.
20	1 a.m.	1 a.m. through 1:59 a.m.
21	2 a.m.	2 a.m. through 2:59 a.m.
22	3 a.m.	3 a.m. through 3:59 a.m.
23	4 a.m.	4 a.m. through 4:59 a.m.
24	5 a.m.	5 a.m. through 5:59 a.m.

* For some MOBILE6 hourly input parameters, overnight hours are grouped. Hourly inputs are representative of the same day or day type, but are reordered for input to MOBILE6 to start at 6 a.m.

Application of MOBILE6 Commands and Associated Input Parameters

All of the MOBILE6 commands that may affect calculating emissions factors (excluding commands such as those that affect only the output format or content) are listed and described in the Tables 19 through 25. Respectively, these seven tables are: MOBILE6 Pollutants and Emission Rates, MOBILE6 External Conditions, MOBILE6 Vehicle Fleet Characteristics,

MOBILE6 Activity, MOBILE6 State Programs, MOBILE6 Fuels, and MOBILE6 Alternative Emissions Regulations and Control Measures. These tables identify the combinations of MOBILE6 commands and parameters used for this analysis.

Parameters associated with each MOBILE6 command are in general labeled as either EPA default, locality- (or county- or region-) specific, or NOT APPLIED. The tabulated commands where associated input parameters are labeled only as "EPA default" are generally not input for this analysis. MOBILE6 technical report (electronic file names available on the EPA MOBILE website [http://www.epa.gov/otaq/models/mobile6/m6tech.htm]) references are provided.

The procedures used to develop the locality-specific inputs to MOBILE6 are detailed following the seven MOBILE6 input category tables.

Table 19
MOBILE6 Pollutants and Emission Rates

Command	Function/Description	Input Parameter Source/Value
POLLUTANTS	Defines the basic set of pollutants to report.	NOT APPLIED. (The MOBILE6 default is assumed: HC, CO, NOx.)
PARTICULATES	Enables computation of particulate matter (PM) an related emissions factors.	NOT APPLIED.
PARTICULATE EF	Specifies location of files that contain the particulate emissions factors when PARTICULATES command is used.	NOT APPLIED.
PARTICLE SIZE	Allows user to specify the maximum particulate size cutoff used by MOBILE.	NOT APPLIED.
EXPRESS HC AS VOC	One of five possible commands that allow the user to specify the particular HC species (non-methane hydrocarbons, non-methane organic gases, total hydrocarbons, total organic gases, and VOC) to report in the exhaust emissions output.	"VOC" command is applied. Only the command is required.
NO REFUELING	Directs MOBILE6 not to calculate refueling emissions factors.	This command is applied. Only the command is required.
AIR TOXICS	Enables the computation of air toxic emissions factors (six explicit pollutants) and specifies which to calculate.	NOT APPLIED.
ADDITIONAL HAPS	Allows entry of emissions factors or air toxic ratios for calculation of additional user-defined air toxic pollutant emissions factors.	NOT APPLIED.
MPG ESTIMATES	Allows entry of alternate fuel economy performance data by vehicle class and model year.	NOT APPLIED. (MOBILE6 default values are assumed.)

Table 20
MOBILE6 External Conditions

Command	Function/Description	Input Parameter Source/Value
CALENDAR YEAR	Identifies calendar year for which emissions factors are to be calculated. (Required to run model).	2000
EVALUATION MONTH	Provides option of calculating January 1 or July 1 emissions factors for calendar year of evaluation.	7 (for July)
MIN/MAX TEMPERATURE	Sets minimum and maximum daily temperatures. (Required to run model if the HOURLY TEMPERATURES command is not used.)	NOT APPLIED. (See HOURLY TEMPERATURES.)
HOURLY TEMPERATURES	Allows temperatures input for each hour of day. (Required to run model if MIN/ MAX TEMPERATURE command is not used.)	County-specific by episode day date, provided by TCEQ (see Appendix E). TTI formatted data into model input sequence: 6 a.m. to 12 a.m. followed by 12 a.m. to 6 a.m. for the same day.
ALTITUDE	Specifies high- or low-altitude for modeling area.	NOT APPLIED. (EPA default, low altitude, is assumed).
ABSOLUTE HUMIDITY	Used to specify daily average humidity (directly affects NOx emissions). MOBILE6 also converts absolute humidity to heat index which affects hydrocarbon (HC) and CO emissions for the portion of the fleet that MOBILE6 determines is using air conditioning.	NOT APPLIED. (See RELATIVE HUMIDITY.)
Environmental Effects on Air Conditioning:	Commands used by MOBILE6 to model the extent of vehicle air-conditioning usage.	
CLOUD COVER	Specifies average percent cloud cover for given day.	NOT APPLIED. (EPA default assumed.)
PEAK SUN	Specifies Mid-Day hours with peak sun intensity.	NOT APPLIED. (EPA default assumed.)
SUNRISE/SUNSET	Allows user to specify time of sunrise and sunset.	Region-specific, 7a.m. and 8p.m., TCEQ.
RELATIVE HUMIDITY	Specifies use of 24 hourly relative humidity values entered by user. MOBILE6 will perform hour-specific calculations with hourly values rather than use single daily default absolute humidity value.	Region-specific by episode day date, provided by TCEQ (see Appendix E). TTI formatted data into model input sequence: 6 a.m. to 12 a.m. followed by 12 a.m. to 6 a.m. for the same day.
BAROMETRIC PRES	Specifies use of user input daily average barometric pressure for use with hourly relative humidity to calculate hourly absolute humidity values.	Region-specific, developed by TTI from data provided by TCEQ (see Appendix E).

Table 21
MOBILE6 Vehicle Fleet Characteristics

Command	Function/Description	Input Parameter Source/Value
REG DIST	Allows the user to supply registration distributions by age for any of the 16 composite (combined gasoline and diesel) vehicle types.	Locality-Specific/EPA default. Developed by TTI. 2000: mid-year 2002 TxDOT BPA three-county aggregate registrations data are applied (see Table 27) except for buses for which the MOBILE6 default is used.
DIESEL FRACTIONS	Permits user to supply locality-specific diesel fractions for 14 of the 16 composite vehicle categories by age.	Locality-Specific/EPA default. Developed by TTI. Beginning in 2002, TxDOT registrations specify gasoline and diesel fueled vehicles for the eight HDV classes. 2000: mid-year 2002 TxDOT county registrations were used to develop the HDV diesel fractions (EPA defaults were applied for the remaining classes). The 2001 and 2002 diesel fractions are dropped and the earliest model year fractions are applied to previous years to complete the 25 model year data set. See Table 29.
MILE ACCUM RATE	Allows the user to supply the annual mileage accumulation rates by vehicle type and age.	NOT APPLIED. (EPA defaults are assumed — see technical report M6FLT.007)
NGV FRACTION	Lets user specify percent of natural gas vehicles (NGV) in the fleet by type and age certified to operate on either compressed or liquefied natural gas.	NOT APPLIED. (The EPA default, zero percent, is assumed.)
NGV EF	Permits the user to enter alternate NGV emissions factors for each of the 28 vehicle types, for running and start emissions.	NOT APPLIED. (The EPA default, none, is assumed.)

Table 22
MOBILE6 Activity

Command	Function/Description	Input Parameter Source/Value
VMT FRACTIONS	Used in MOBILE6 to weight the emissions of various vehicle types into average rates for groupings of vehicle classes.	NOT APPLIED. (EPA default assumed, used for aggregate results with no impact on this analysis. VMT mix is applied to link VMT outside MOBILE6 later in the process to calculate emissions by the 28 vehicle types.)
VMT BY FACILITY	VMT fractions by MOBILE6 road type combine the four road type emissions factors into the "all road types" emissions factors.	NOT APPLIED. (EPA default assumed, used for aggregate results with no impact on this analysis.)
VMT BY HOUR	Allows VMT fractions allocation by hour-of-day; applied in conversion of grams per hour (g/hr) to g/mi, as well as in weighting of hourly g/mi rates to obtain daily emissions factors.	Region-specific by day-type. The hourly VMT fractions are based on multi-year, recent, regional, August TxDOT automatic traffic recorder (ATR) counts.
SPEED VMT	Allows user to allocate VMT by average speed (14 pre-selected: 2.5 and 5 through 65 at 5 mph increments) for arterials and freeways for each hour of the day.	Generic input. Same for all counties. Inputs are set up to calculate emissions factors by 14 MOBILE6 speed bin speed scenarios for MOBILE6 freeway and arterial road types.
AVERAGE SPEED	Allows a single average speed for combined freeways and arterials for the entire day.	NOT APPLIED.
STARTS PER DAY	Lets user specify the average number of engine starts per vehicle per day by vehicle types for weekend days and weekdays.	NOT APPLIED. (The EPA weekday defaults assumed — see technical report M6FLT.003.)
START DIST	Allows user to allocate engine starts by hour of the day for weekend days and weekdays.	NOT APPLIED. (The EPA weekday defaults assumed — see technical report M6FLT.003.)
SOAK DISTRIBUTION	Allows use of alternate vehicle soak duration distributions for weekend days and weekdays.	NOT APPLIED. (The EPA weekday defaults assumed — see technical reports M6FLT.003 and 004.)
HOT SOAK ACTIVITY	Allows users to specify a hot soak duration distribution for each of 14 daily time periods for weekend days and for weekdays.	NOT APPLIED. (The EPA weekday defaults assumed — see technical reports M6FLT.003 and 004.)
DIURN SOAK ACTIVITY	Allows user set diurnal soak time distributions for each of 18 daily time periods.	NOT APPLIED. (The EPA defaults are assumed. — see technical report M6FLT.006.)
WE DA TRI LEN DI	Specifies alternate fractions of VMT that occur during trips of various durations at each hour of the average weekday.	NOT APPLIED. (The EPA defaults are assumed. — see technical report M6FLT.005.)
WE EN TRI LEN DI	Specifies hourly alternate fractions of VMT for trips of various lengths for weekend days.	NOT APPLIED.
WE VEH US	Directs MOBILE6 to use weekend activity data for calculating emissions factors.	Applied command for weedend day analyses (i.e., August 26, 27).

Table 23
MOBILE6 State Programs

Command	Function/Description	Input Parameter Source/Value
STAGE II REFUELING	Allows modeling of at-the-pump refueling emissions.	NOT APPLIED. Accounted for as an area source category.
ANTI-TAMP PROG	Allows user to model impacts of an ATP.	NOT APPLIED. (Although Texas administers a statewide ATP, ATP credit is only taken in those counties which also administer and enforce an I/M program.)
I/M Commands:		NOT APPLIED.
I/M PROGRAM	Required for exhaust/evaporative I/M programs.	
I/M MODEL YEARS	Required for exhaust/evaporative I/M programs.	
I/M VEHICLES	Required for exhaust/evaporative I/M programs.	
I/M STRINGENCY	Required for exhaust. Do not use for evaporative.	
I/M COMPLIANCE	Required for exhaust. Optional for evaporative.	
I/M WAIVER RATES	Required for exhaust. Optional for evaporative.	
I/M CUTPOINTS	Optional for exhaust (but required for IM240). Do not use with evaporative.	
I/M EXEMPTION AGE	Optional for both exhaust and evaporative.	
I/M GRACE PERIOD	Optional for both exhaust and evaporative.	
NO I/M TTC CREDITS	Optional for exhaust. Do not use with evaporative.	
I/M EFFECTIVENESS	Optional for exhaust. Do not use with evaporative.	
I/M DESC FILE	Optional for both.	

Table 24
MOBILE6 Fuels

Command	Function/Description	Input Parameter Source/Value
FUEL PROGRAM	Allows specification of one of four options: 1) Conventional Gasoline East Tier2 sulfur phase-in schedule (includes Texas), 2) Reformulated Gasoline (RFG), 3) Conventional Gasoline West Tier2 sulfur geographical phase-in area schedule, or 4) Sulfur content for gasoline after 1999.	Option 1: Applied for all counties.
SULFUR CONTENT	(or GASOLINE SULFUR) Allows use of alternate sulfur content for conventional gasoline through calendar year 1999.	NOT APPLIED. (See FUEL PROGRAM Option above).
DIESEL SULFUR	Allows use of ave. diesel fuel sulfur level for all calendar years. Required if PARTICULATES command is used. No affect on HC, CO, NOx or air toxics (except if calculated as ratio to PM).	NOT APPLIED.
OXYGENATED FUELS	Allows modeling of oxygenated gasoline effects on exhaust for all gasoline-fueled vehicle types. Not for use with AIR TOXICS command.	NOT APPLIED.
FUEL RVP	Allows user to specify fuel RVP for area being modeled (required to run model).	Region-specific. For 2000 use federal limit, per EPA guidance for areas without gasoline survey data (Procedures For Emissions Inventory Prep., Vol. 1V, EPA 1992). 2000: 7.8 psi
SEASON	Identifies effective season for RFG calculation regardless of month modeled.	NOT APPLIED.
GAS AROMATIC%	Only when AIR TOXICS command is used.	NOT APPLIED.
GAS OLEFIN%	Only when AIR TOXICS command is used.	NOT APPLIED.
GAS BENZENE%	Only when AIR TOXICS command is used.	NOT APPLIED.
E200	Only when AIR TOXICS command is used.	NOT APPLIED.
E300	Only when AIR TOXICS command is used.	NOT APPLIED.
OXYGENATE	Only when AIR TOXICS command is used.	NOT APPLIED.
RVP OXY WAIVER	Only when AIR TOXICS command is used.	NOT APPLIED.

Table 25
MOBILE6 Alternative Emissions Regulations and Control Measures

Command	Function/Description	Input Parameter Source/Value
NO CLEAN AIR ACT	Models vehicle emissions as if the Federal Clean Air Act Amendments of 1990 had not been implemented.	NOT APPLIED.
HDDV NOx Off-Cycle Emissions Effects:		
NO DEFEAT DEVICE	Turns off the effects of the HDD vehicle NOx off-cycle emissions effects (defeat device emissions).	NOT APPLIED.
NO NOX PULL AHEAD	Turns off HDD NOx emissions reduction effects of Pull- Ahead program.	NOT APPLIED.
NO REBUILD	Turns off HDD NOx emissions reduction effects of Rebuild program.	NOT APPLIED.
REBUILD EFFECTS	Allows user change Rebuild program effectiveness rate.	APPLIED. Used EPA default, 0.90.
Tier 2 Emission Standards and Fuel Requirements:	Allow the overriding of the default Tier 2 emissions standards and fuel requirements settings.	
NO TIER2	Disables Tier 2 requirements.	NOT APPLIED.
T2 EXH PHASE-IN	Allows alternate Tier 2 exhaust standard phase-in schedules.	
T2 EVAP PHASE-IN	Allows alternate Tier 2 evaporative standard phase-in schedules.	
T2 CERT	Allows user to specify alternate Tier 2 50,000-mile certification standards.	
94+ LDG IMPLEMENTATON	Allows use of alternate 1994 and later fleet penetration fractions for LDGVs under the Tier 1, NLEV (or California LEV 1), and Tier 2 emissions standard programs.	NOT APPLIED.
NO 2007 HDDV RULE	Disables 2007 HDV emissions standards.	NOT APPLIED.

External Conditions – Locality Specific Inputs to MOBILE6

MOBILE6 local inputs for hourly temperatures, daily average humidity, and sunrise and sunset times were developed and applied by calendar day based on local (central daylight) time. TCEQ developed the values (these are the same data that TCEQ developed for the initial BPA MOBILE6 modeling EI effort performed in 2002, however, hourly relative humidity is applied rather than the previously used and less accurate absolute daily humidity input, and barometric pressure input is included), and TTI formatted them for input to MOBILE6. These same MOBILE6 inputs were used to develop the corresponding set of August 2005 future base-case ozone episode on-road mobile source emissions inventories (documented separately under this task).

Temperatures (HOURLY TEMPERATURES Command)
TCEQ developed ambient hourly temperatures (degrees Fahrenheit) for input to MOBILE6 by county for each of the series of days, August 22, 2000 to September 1, 2000. The temperatures are hourly averages from monitoring stations within the BPA counties. TCEQ used monitoring data from the EPA Aerometric Information Retrieval System, the National Weather Service, and TCEQ Monitoring Operations. Each county with more than one monitoring station uses the hourly average temperatures from the monitoring stations within its border. Counties without monitoring stations (i.e., Hardin), use average hourly temperatures from monitoring stations from adjacent counties.

The MOBILE6 User's Guide states that the 24 hourly temperature inputs are to be entered from 6 a.m. continuing through 5 a.m. of the "next day." The emissions estimation method applied by TTI, however, applies the hourly input data by "calendar day." This calendar day method simplifies the emissions estimation process, especially when modeling consecutive calendar days exhibiting different hourly travel activity. Thus, the hourly average temperatures for each calendar day provided by TCEQ were sequenced starting with 6 a.m. through 11 p.m. followed by 12 a.m. through 5 a.m. of the same calendar day. EPA approves of this procedure.

TTI processed and applied 12 hourly temperature input data sets, one for each of the three counties for each of the four episode analysis days. The temperatures are input in the MOBILE6 command file. Appendix E shows a summary of the temperatures used.

Relative Humidity (RELATIVE HUMIDITY Command)
The RELATIVE HUMIDITY command was used to specify hourly percent relative humidity values for the three-county nonattainment area.

TCEQ provided hourly relative humidity values from one monitoring station in the region (South East Texas Regional Airport). TTI applied the same hourly relative humidity inputs for all three counties. The humidity parameter is input in the MOBILE6 command file. Appendix E shows the humidity values used.

Barometric Pressure (BAROMETRIC PRES Command)
The BAROMETRIC PRES command was used to specify the 24-hour average barometric pressure value (in units of inches of Mercury) for the nonattainment area for each episode day.

The daily barometric pressure inputs were developed by averaging the hourly barometric pressure data corresponding to the hourly relative humidity values from the South East Texas Regional Airport weather station. The barometric pressure is input in the MOBILE6 command file. The barometric pressure input values are shown in Appendix E.

Sunrise and Sunset Times (SUNRISE/SUNSET Command)
The SUNRISE/SUNSET command allows the user to specify the hour of sunrise and sunset. This feature affects only the air-conditioning correction. TCEQ provided the sunrise and sunset times which are the same for all counties and days. The times are 7 a.m. and 8 p.m. central daylight time.

Vehicle Fleet Characteristics

Vehicle registration (age) distributions and diesel fractions inputs to MOBILE6 were developed from TxDOT mid-year 2002 county vehicle registration data for those vehicle types where TxDOT registrations data were available. EPA defaults were used where necessary. Due to sparse registration data for some vehicle classes resulting from the increased disaggregation level of the vehicle classifications in MOBILE6 (28 vehicle types versus the previous eight vehicle class scheme), the registrations data are grouped for the three county nonattainment area for developing the age distributions input, and grouped for the state for developing the diesel fractions inputs.

Vehicle Registration Distributions (REG DIST Command)

The user-supplied vehicle registration distributions input to MOBILE6 are by vehicle age for any of the 16 composite (combined gas and diesel) vehicle types as shown in Table 26. EPA default distributions are internally applied by MOBILE6 for vehicle classes for which the user does not provide alternate values. The input values for each vehicle class are 25 age fractions representing the fraction of vehicles by age for that particular vehicle class as of July of the evaluation year. These age fractions start with the evaluation year as the 1st age fraction and work back in annual increments to end with the 25th fraction, which represents the fraction of vehicles of age 25 years and older. The fractions are calculated as the model year-specific registrations in a class divided by the total vehicles registered in that class.

Table 26
Composite Vehicle Classes for Vehicle Registration Data
(REG DIST Command)

Number	Abbreviation	Description
1	LDV	Light-Duty Vehicles (Passenger Cars)
2	LDT1	Light-Duty Trucks 1 (0-6,000 lbs. GVWR, 0-3,750 lbs. LVW)
3	LDT2	Light-Duty Trucks 2 (0-6,000 lbs. GVWR, 3,751-5,750 lbs. LVW)
4	LDT3	Light-Duty Trucks 3 (6,001-8,500 lbs. GVWR, 0-5,750 lbs. ALVW*)
5	LDT4	Light-Duty Trucks 4 (6,001-8,500 lbs. GVWR, 5,751 lbs. and greater ALVW)
6	HDV2B	Class 2b Heavy-Duty Vehicles (8,501-10,000 lbs. GVWR)
7	HDV3	Class 3 Heavy-Duty Vehicles (10,001-14,000 lbs. GVWR)
8	HDV4	Class 4 Heavy-Duty Vehicles (14,001-16,000 lbs. GVWR)
9	HDV5	Class 5 Heavy-Duty Vehicles (16,001-19,500 lbs. GVWR)
10	HDV6	Class 6 Heavy-Duty Vehicles (19,501-26,000 lbs. GVWR)
11	HDV7	Class 7 Heavy-Duty Vehicles (26,001-33,000 lbs. GVWR)
12	HDV8A	Class 8a Heavy-Duty Vehicles (33,001-60,000 lbs. GVWR)
13	HDV8B	Class 8b Heavy-Duty Vehicles (>60,000 lbs. GVWR)
14	HDBS	School Buses
15	HDBT	Transit and Urban Buses
16	MC	Motorcycles (All)

* The adjusted loaded vehicle weight is the numerical average of the vehicle curb weight and the GVWR.
Source: MOBILE6 User's Guide (EPA, January 2002).

TTI developed MOBILE6 age distributions fractions input from TxDOT data for all vehicle types except for the two bus categories. EPA defaults were used for the two bus categories. To develop these distributions, TTI used two county-level data sets provided by TxDOT. The TxDOT registrations data provided are summarized as:

- July 2002 registrations for:
  gasoline and diesel: LDV, LDT12, LDT34, MC, HDGT, HDDT; and
- July 2002 registrations for:
  gasoline: HDV2B, HDV3, HDV4, HDV5, HDV6, HDV7, HDV8A, HDV8B; and
  diesel: HDV2B, HDV3, HDV4, HDV5, HDV6, HDV7, HDV8A, HDV8B.

The July 2002 registrations are for: automobiles, light duty trucks (LDT12, corresponding to MOBILE6 classes LDT1 and LDT2), heavier light-duty trucks (LDT34, corresponding to MOBILE6 classes LDT3 and LDT4), motorcycles, heavy-duty gas trucks (> 8,500 lbs. GVWR), and heavy duty diesel trucks (> 8,500 lbs. GVWR). The July 2002 gasoline and diesel HDV classes (eight each) comprise the July 2002 HDGT and HDDT classes represented in the July

2002 data set, respectively, and correspond to the eight HDV weight classes for numbers six through 13 in Table 26.

First the county registrations data for the three counties were combined. There are three main steps to developing the MOBILE6 registration distributions input for the 14 non-bus vehicle classes. The first step in the process develops the July 2002 registrations by the 25 age groups for 12 of the 16 composite (by fuel) vehicle classes (eight HDV, LDV, LDT12, LDT34, MC). The second step converts the registrations from numbers of vehicles registered, to fractions registered by age for each of these 12 classes. The registrations are then expanded from 12 to 14 vehicle classes.

The 16 HDV class registrations were combined into the MOBILE6 eight composite (gasoline and diesel) classes by summing the individual fuel type registrations by age within each weight category. The 1978 and older registrations were summed to yield the "age 25 and older" registrations for each of the 12 composite vehicle classes (i.e. the eight HDV classes plus LDV, LDT12, LDT34, and MC.

The conversion of the registrations from numbers of vehicles to fractions of vehicles by age was made for each vehicle class by dividing the registrations for each age by the total registrations. MOBILE6 requires that the age distribution fractions for each vehicle class sum to one. In this step the age distribution fractions for each class were summed. For sums not equal to one (due to rounding error), the largest registration fraction was adjusted to make the fractions sum to one.

The resulting July 2002 estimated BPA nonattainment area registration distribution fractions for the 12 composite classes were then expanded to 14 classes. This was accomplished by using the LDT12 age fractions, for both the MOBILE6 LDT1 and LDT2 classes and the LDT34 age fractions for both the MOBILE6 LDT3 and LDT4 classes. The MOBILE6 vehicle registration distributions are input from external data files. The external data files were provided to TxDOT on CD-ROM. Appendix A lists the data files submitted. The registration distributions input is shown in Table 27.

Table 27
BPA Three-County Aggregate MOBILE6 Registration Distributions* Input

```
LDV
  1  0.05521 0.07730 0.09104 0.07907 0.07355 0.06972 0.06520 0.07049 0.05910 0.05493
     0.04838 0.04396 0.03937 0.03448 0.02751 0.02103 0.01792 0.01667 0.01303 0.00752
     0.00507 0.00408 0.00319 0.00390 0.01828
LDT1
  2  0.07136 0.08408 0.07343 0.07273 0.06944 0.06840 0.05914 0.06258 0.06422 0.04736
     0.04340 0.04294 0.03473 0.03502 0.02773 0.01917 0.02088 0.01870 0.01731 0.01073
     0.01173 0.00967 0.00465 0.00612 0.02448
LDT2
  3  0.07136 0.08408 0.07343 0.07273 0.06944 0.06840 0.05914 0.06258 0.06422 0.04736
     0.04340 0.04294 0.03473 0.03502 0.02773 0.01917 0.02088 0.01870 0.01731 0.01073
     0.01173 0.00967 0.00465 0.00612 0.02448
LDT3
  4  0.12988 0.15533 0.11562 0.14216 0.05695 0.08228 0.06160 0.05250 0.03233 0.03105
     0.02488 0.01508 0.01400 0.01546 0.01018 0.00515 0.00993 0.00859 0.00827 0.00515
     0.00445 0.00293 0.00255 0.00369 0.00999
LDT4
  5  0.12988 0.15533 0.11562 0.14216 0.05695 0.08228 0.06160 0.05250 0.03233 0.03105
     0.02488 0.01508 0.01400 0.01546 0.01018 0.00515 0.00993 0.00859 0.00827 0.00515
     0.00445 0.00293 0.00255 0.00369 0.00999
HDV2
  6  0.16054 0.19730 0.10816 0.15782 0.07279 0.05986 0.03401 0.03061 0.02177 0.02653
     0.01361 0.01361 0.01837 0.00884 0.01361 0.00816 0.00952 0.00680 0.00748 0.00068
     0.00476 0.00340 0.00544 0.00000 0.01633
HDV3
  7  0.06554 0.08614 0.10300 0.11797 0.03371 0.09925 0.04682 0.09176 0.05243 0.04682
     0.03933 0.02247 0.02622 0.02622 0.03371 0.00936 0.00749 0.00936 0.00375 0.00562
     0.00749 0.00562 0.00187 0.00749 0.05056
HDV4
  8  0.03529 0.07059 0.08627 0.17257 0.06667 0.12157 0.10588 0.07451 0.03137 0.02745
     0.03529 0.02745 0.04706 0.01176 0.00784 0.01569 0.00392 0.00392 0.00000 0.00000
     0.00392 0.00000 0.00392 0.00000 0.04706
HDV5
  9  0.06135 0.12270 0.13502 0.12270 0.03681 0.07975 0.02454 0.04908 0.01227 0.04294
     0.01840 0.00613 0.01227 0.05521 0.03067 0.00613 0.02454 0.01840 0.01227 0.01227
     0.00613 0.02454 0.00000 0.00613 0.07975
HDV6
 10  0.04112 0.05263 0.09539 0.09703 0.06250 0.05757 0.05263 0.03947 0.03947 0.06086
     0.04112 0.06908 0.02632 0.02632 0.02632 0.02467 0.01316 0.02632 0.02467 0.00493
     0.02138 0.02467 0.00822 0.00658 0.05757
HDV7
 11  0.00797 0.03187 0.06375 0.05179 0.09163 0.03187 0.02789 0.06773 0.06773 0.05976
     0.07968 0.10360 0.03984 0.01195 0.03586 0.02390 0.01594 0.04781 0.02390 0.00000
     0.01195 0.02390 0.01594 0.01992 0.04382
HDV8A
 12  0.00735 0.00882 0.02206 0.05294 0.03088 0.00882 0.03382 0.04412 0.07206 0.08676
     0.05147 0.06029 0.07059 0.09707 0.03824 0.04706 0.03088 0.04412 0.04118 0.01176
     0.01765 0.03088 0.02059 0.02059 0.05000
HDV8B
 13  0.01498 0.10112 0.12921 0.14607 0.13296 0.05805 0.09925 0.20413 0.08801 0.00187
     0.00375 0.00749 0.00562 0.00375 0.00000 0.00000 0.00187 0.00000 0.00000 0.00000
     0.00000 0.00000 0.00000 0.00000 0.00187
 HDBS is MOBILE6 default
 HDBT is MOBILE6 default
MC
 16  0.11973 0.16122 0.13060 0.08887 0.06519 0.05737 0.04976 0.03803 0.02999 0.01999
     0.01673 0.00913 0.00978 0.01239 0.01130 0.01130 0.02086 0.01782 0.01195 0.01347
     0.01630 0.01260 0.01608 0.01043 0.04911
```

* Based on TxDOT mid-year 2002 county registrations data.

Diesel Fractions (DIESEL FRACTIONS Command)
The DIESEL FRACTIONS command allows the user to specify diesel fractions for 14 of the 16 composite (gasoline and diesel) vehicle categories by vehicle age. MOBILE6 assumes that urban/transit buses are 100 percent diesel, and that motorcycles are all gasoline fueled, so these two categories do not require diesel fractions. The diesel fraction represents the portion of diesels in a composite (gasoline and diesel) vehicle class for any vehicle age. When the user enters diesel fractions, all 14 sets of fractions are required. Each set of fractions contains the diesel fractions for 25 vehicle ages from the evaluation year back through the 25th fraction, which represents vehicle ages of 25 years and older.

The MOBILE6 default fractions vary by age for model years 1972 through 1996. For 1971 and earlier model years, the default diesel fractions are assumed the same as the 1972 model year fractions. For the 1997 and later model years, the default diesel fractions are assumed the same as the 1996 model year fractions.

TTI developed evaluation year-specific, state-level diesel fractions inputs for the analysis. TTI used a combination of estimated TxDOT diesel fractions and EPA default diesel fractions for modeling the emissions factors. Table 28 shows the MOBILE6 diesel fractions input categories with corresponding data sources. The diesel fraction estimates were calculated based on TxDOT individual diesel and gasoline vehicle registrations for the eight HDV (HDV2b through HDV8b) weight classes. To produce the HDV diesel fractions by model year, the diesel registrations were divided by the sum of the gasoline and diesel registrations, by HDV composite vehicle class, and model year.

Table 28
Source of Diesel Fractions for Composite Vehicle Types
(DIESEL FRACTIONS Command)

Number	Abbreviation	Description	Source of Fractions
1	LDV	Light-Duty Vehicles	EPA MOBILE6 Evaluation Year Default
2	LDT1	Light-Duty Trucks 1	EPA MOBILE6 Evaluation Year Default
3	LDT2	Light-Duty Trucks 2	EPA MOBILE6 Evaluation Year Default
4	LDT3	Light-Duty Trucks 3	EPA MOBILE6 Evaluation Year Default
5	LDT4	Light-Duty Trucks 4	EPA MOBILE6 Evaluation Year Default
6	HDV2B	Class 2b Heavy-Duty Vehicles	TxDOT July, 2002 Statewide Registrations
7	HDV3	Class 3 Heavy-Duty Vehicles	TxDOT July, 2002 Statewide Registrations
8	HDV4	Class 4 Heavy-Duty Vehicles	TxDOT July, 2002 Statewide Registrations
9	HDV5	Class 5 Heavy-Duty Vehicles	TxDOT July, 2002 Statewide Registrations
10	HDV6	Class 6 Heavy-Duty Vehicles	TxDOT July, 2002 Statewide Registrations
11	HDV7	Class 7 Heavy-Duty Vehicles	TxDOT July, 2002 Statewide Registrations
12	HDV8A	Class 8a Heavy-Duty Vehicles	TxDOT July, 2002 Statewide Registrations
13	HDV8B	Class 8b Heavy-Duty Vehicles	TxDOT July, 2002 Statewide Registrations
14	HDBS	School Buses	EPA MOBILE6 Evaluation Year Default

To estimate the 2000 analysis year HDV diesel fractions, the 2001 and 2002 model year fractions were removed and the oldest model year fractions in the data set were used for each earlier model year to complete the diesel fractions data set to the 25th model year for each vehicle class. The estimated 2000 HDV diesel fractions were then combined with the corresponding evaluation year-specific EPA default diesel fractions for the remaining vehicle classes (LDV, LDT1, LDT2, LDT3, LDT4, and HDBS) to produce the complete input data set. Diesel fractions are entered in the MOBILE6 command file. The diesel fractions input is shown in Table 29.

Table 29
2000 Diesel Fractions MOBILE6 Input*

```
DIESEL FRACTIONS   :
 0.00090 0.00090 0.00090 0.00090 0.00090 0.00060 0.00010 0.00030 0.00060 0.00130
 0.00040 0.00040 0.00010 0.00270 0.00320 0.00970 0.01620 0.02410 0.05100 0.07060
 0.03900 0.02690 0.01140 0.00930 0.01370
 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000
 0.00000 0.00000 0.00000 0.00070 0.00330 0.00480 0.01200 0.02230 0.06560 0.06160
 0.04390 0.03160 0.02590 0.00000 0.01870
 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000
 0.00000 0.00000 0.00000 0.00070 0.00330 0.00480 0.01200 0.02230 0.06560 0.06160
 0.04390 0.03160 0.02590 0.00000 0.01870
 0.01260 0.01260 0.01260 0.01260 0.01260 0.01150 0.01110 0.01450 0.01150 0.01290
 0.00960 0.00830 0.00720 0.00820 0.01240 0.01350 0.01690 0.02090 0.02560 0.00130
 0.00060 0.00110 0.00010 0.00000 0.00000
 0.01260 0.01260 0.01260 0.01260 0.01260 0.01150 0.01110 0.01450 0.01150 0.01290
 0.00960 0.00830 0.00720 0.00820 0.01240 0.01350 0.01690 0.02090 0.02560 0.00130
 0.00060 0.00110 0.00010 0.00000 0.00000
 0.61397 0.66232 0.57703 0.47784 0.45121 0.20063 0.39808 0.37552 0.32844 0.35352
 0.27226 0.22309 0.17730 0.14483 0.20196 0.17056 0.19074 0.17148 0.14044 0.00323
 0.00000 0.00382 0.00303 0.00303 0.00303
 0.65615 0.64013 0.51450 0.57439 0.54389 0.32661 0.55020 0.58601 0.62333 0.51890
 0.51653 0.46856 0.35294 0.25512 0.29752 0.17664 0.22368 0.21759 0.16066 0.03297
 0.01508 0.00373 0.00406 0.00406 0.00406
 0.72152 0.63857 0.67967 0.73075 0.66667 0.44671 0.70203 0.69632 0.65581 0.65789
 0.57317 0.60350 0.35745 0.24855 0.13542 0.12313 0.18852 0.13253 0.17797 0.14583
 0.05000 0.03185 0.01034 0.01034 0.01034
 0.89367 0.88016 0.75422 0.72991 0.80476 0.45659 0.67857 0.72535 0.65432 0.70483
 0.60383 0.59509 0.41699 0.33654 0.25337 0.30960 0.25418 0.28244 0.20767 0.23790
 0.14394 0.12340 0.03350 0.03350 0.03350
 0.86671 0.86169 0.81933 0.74312 0.78239 0.54923 0.77170 0.75818 0.57117 0.66954
 0.72241 0.69427 0.56318 0.62198 0.54717 0.46968 0.43758 0.40440 0.37461 0.43137
 0.18953 0.14992 0.04644 0.04644 0.04644
 0.90479 0.88593 0.84672 0.75646 0.81899 0.48829 0.82916 0.84387 0.84789 0.85788
 0.83389 0.82784 0.81143 0.81176 0.78571 0.74359 0.73051 0.70909 0.63052 0.70608
 0.36715 0.27615 0.20888 0.20888 0.20888
 0.93355 0.94685 0.94189 0.86917 0.90694 0.67588 0.96360 0.95187 0.94895 0.93046
 0.94083 0.94469 0.95000 0.94092 0.91551 0.91340 0.92834 0.91875 0.91908 0.88970
 0.56726 0.56641 0.55152 0.55152 0.55152
 0.99167 0.98288 0.98189 0.95390 0.99119 0.78746 0.96058 0.98670 0.96262 1.00000
 0.95333 0.97500 0.95238 0.92424 0.92958 0.98969 0.95455 0.97143 0.94286 0.96296
 0.40000 0.44444 0.51064 0.51064 0.51064
 0.95850 0.95850 0.95850 0.95850 0.95850 0.88570 0.85250 0.87950 0.99000 0.91050
 0.87600 0.77100 0.75020 0.73450 0.67330 0.51550 0.38450 0.32380 0.32600 0.26390
 0.05940 0.04600 0.02910 0.02400 0.00860
```

* Based on TxDOT Stateswide mid-year 2002 county registrations data except EPA fractions are used for LDV, LDT and Bus.

Activity
The locality-specific activity parameters used to develop the hourly emissions factors are fleet hourly VMT fractions (through the VMT BY HOUR command).

Additional non-default, but generic activity inputs used in the modeling were hourly fractions of VMT by the 14 speeds for arterials and freeways (SPEED VMT command). Also, weekend day hourly vehicle usage rates (MOBILE6 defaults) for particular activity input parameters (through the WE VEH US command) were applied for the Saturday and Sunday episode days.

VMT Fractions (also known as VMT mix)
These sets of fractions (VMT fractions attributable to individual vehicle classes) are an input to MOBILE6, however, the method for this study calls for the application of the VMT mix (or mixes) later in the emissions calculation process. VMT mix development was discussed previously in this documentation.

Total VMT by Hour (VMT BY HOUR Command)
Hourly fleet total VMT distributions are input to MOBILE6 by using the VMT BY HOUR command. These fractions are used by MOBILE6 to convert the units of the non travel-related hourly emissions factors (e.g., hot soak, diurnal, start, etc.) to units of g/mi. (The VMT by hour fractions are also used to produce the daily emissions factors as composites of the hourly emissions factors.)

Development of the hourly VMT fractions for the BPA three-county nonattainment area were previously discussed in the "Hourly Travel Factors" section. These same hourly VMT fractions, used to distribute HPMS VMT by hour of day, are applied as input to MOBILE6. The MOBILE6 input sequence starts with the 6 a.m. fraction.

To summarize, TxDOT continuous ATR data (for 1999 and 2001) are aggregated for the three counties to develop the BPA hourly travel factors. Hourly travel factors were developed for each of the four day types. Using the day type-specific volumes, these factors are the ratio of hourly volumes to 24-hour volume.

These fractions are input to MOBILE6 as an external data file. The hourly travel factors are shown in Table 4. The factors in MOBILE6 external data file format are provided on CD-ROM, as described in Appendix A.

VMT Distribution by Average Speed on Freeways and Arterials (SPEED VMT Command)
The VMT distributions by average speed inputs are called by the SPEED VMT command, but are accommodated internally by the POLFAC62 program (that is, no user speed input commands or data parameter values are required when producing MOBILE6 emissions factors tables with POLFAC62). POLFAC62 uses the SPEED VMT inputs to produce the individual Freeway and Arterial emissions factors indexed by the 14 MOBILE6 speed bin speeds.

There are 14 scenarios, each with 100 percent of Freeway and Arterial VMT set to one of the 14 MOBILE speed bin speeds. Each scenario produces a set of Arterial and Freeway emissions factors corresponding to one of the 14 speeds.

Weekend Day Vehicle Usage (WE VEH US Command)
MOBILE6 supplies default weekend day hourly vehicle usage rates for start distributions, soak distributions, hot soak activity, and trip length distributions. For Saturday and Sunday day types the WE VEH US command was applied to model the EPA default weekend usage rates for these parameters, however, MOBILE6 uses only the default weekday trip length distributions for both weekday and weekend day types.

State Programs
There are no MOBILE6 State Programs descriptive inputs (i.e., inspection and maintenance, anti-tampering, and stage II refueling programs) modeled.

Fuels – Locality-Specific Inputs to MOBILE6
User input for fuel effects modeling for BPA 2000 includes only the FUELS PROGRAM and FUEL RVP commands and associated input parameters.

Fuel Program (FUEL PROGRAM Command)
The MOBILE6 FUEL PROGRAM command provides the user four options for modeling fuels effects. The first option, Conventional Gasoline East, which is also the MOBILE6 default, was modeled for all three counties. This option supplies post-1999 gasoline sulfur levels by year under the Tier 2 rule phase-in schedule for most states (including Texas). The FUEL PROGRAM option is entered in the MOBILE6 command file.

Gasoline RVP (FUEL RVP Command)
The BPA regulated RVP limit of 7.8 psi was applied for 2000. No BPA gasoline sample survey data were available for comparison. Application of the regulated RVP limit follows EPA RVP determination guidance from Procedures for Emissions Inventory Preparation, Volume IV: Mobile Sources (EPA 1992).

MOBILE6 Alternative Emissions Regulations and Control Measures Commands
The only user-input value applied within this section of MOBILE6 commands is related to the HDDV NOx off-cycle emissions effects.

In the late 1980s and most of the 1990s, HDDV engines were built with “defeat devices” allowing in-use engine emissions to be higher than emissions as specified under Federal Test Procedure conditions. MOBILE6 includes estimates of these excess HDDV emissions as well as the emissions offsetting effects of two programs—early pull-ahead of 2004 HDDV emissions standards, and low emissions rebuilds of existing engines.

EPA provided information to TCEQ that lead to the conclusion that the best estimate for the effectiveness rate for the 2000 ozone episode base-case modeling for the low NOx emissions rebuilds program for heavy duty diesels was 1.0 percent. The information provided by EPA

showed that the number of low NOx-rebuild kits supplied (as of January, 2002) to the affected population was 0.97 percent.

Thus, in MOBILE6 the effectiveness rate for the low NOx emissions rebuild program was set at 1.0 percent through the REBUILD EFFECTS command in the command file.

Using the above-described MOBILE6 input parameters and options, MOBILE6 input files were set up and run with the POLFAC6 program for each analysis day. The resulting tabulated hourly emissions factors indexed by speed, MOBILE6 drive cycle, vehicle type, and pollutant-specific emissions type were input to the emissions calculation program, IMPSUM6. The modeled emissions factors are provided on CD-ROM. See Appendix A for file names and descriptions.

EMISSIONS CALCULATIONS

Hourly emissions were calculated at the network link level using the IMPSUM62 program (Appendix B). Generally, for each hour the episode day link-VMT estimates were multiplied by the episode day composite emissions factors (g/mi) to produce hourly emissions estimates for each of the 28 vehicle types and each pollutant on each network link (the MOBILE6 Freeway, Arterial or Ramp emissions factors were used depending on the link facility type code). For each day, 75 files were output from the emissions calculations. These files include: 72 hourly link emissions files (24 hours multiplied by three counties), a summary file of county-level and area total hourly and 24-hour emissions estimates cross classified by vehicle type and road type, a tab-delimited version of the emissions summary file, and the file that logged the execution of the emissions calculation programs. These files are provided on CD-ROM (see Appendix A).

Hourly Link Emissions

Ozone season weekday emissions were first calculated by hour for each network and intrazonal link (indexed to county and road type) using the following basic inputs:

- MOBILE6 emissions factors indexed by pollutant, speed, emission type, hour, road type and vehicle type, as developed with POLFAC62 (and RATEADJV6);

- records associating the MOBILE6 drive-cycle-specific emissions factors with the appropriate functional classification codes (or facility type codes) used in the network links;

- link data from the assignment results as developed (for each hour) using the PREPIN2BW program including: county number, functional classification (or facility type) number, VMT on link, operational link-speed estimate, link node (end point) numbers, and link distance; and

- VMT mix (to allocate link-VMT by each of the 28 vehicle types) by time period and roadway type.

For each county, day and hour, the emissions estimates were computed by vehicle type for each link. The analysis day emissions factors, discussed previously, were tabulated by pollutant, emissions type, hour, road type (drive cycle), vehicle type, and 14 speeds (2.5 mph and 5 mph to 65 mph at 5 mph intervals) for each county. The county coded hourly fleet total link VMT estimates were first stratified by vehicle type. The time period and functional classification group-specific VMT mixes were correlated to the appropriate links (by functional classification code and hour of day) and were multiplied by the fleet total link VMT to produce the hourly link VMT estimates by the 28 vehicle types. The composite emissions factors for each pollutant were then matched with appropriate link-level VMT based on road type drive cycle, vehicle class and speed. Emissions factors for link speeds that are not represented in the set of 14 MOBILE6 speed bin speeds were calculated by interpolation (see example calculation, Appendix B). For link speeds greater than or less than the MOBILE6 bounding speeds of 65 mph and 2.5 mph, the emissions factors corresponding to those bounding speeds were applied, respectively. The link VMT were then multiplied by the emissions factors to produce the link-level emissions estimates.

Table 30 shows the BPA TDM network facility type groupings used to allocate the MOBILE6 drive-cycle-specific emissions factors and VMT mix to the links based on facility type code. The four-period time-of-day VMT mixes were applied by peak and off-peak periods where 7 a.m. to 8 a.m. is the AM Peak and 5 p.m. to 6 p.m. is the PM Peak. The day hours between the AM Peak and PM Peak use the Mid-Day period VMT mix and the night hours between the PM Peak and AM Peak use the Overnight VMT mix.

Table 30
BPA Network Facility Type Groups for VMT Mix and MOBILE6 Emissions Factors

MOBILE6 Drive Cycle	Facility Type (Code and Name)	VMT mix Group
Freeway	1. Interstate Highway - 10	Freeway
	2. Freeway - main lanes only	
	3. Parkway	
Ramp	29. Ramp	Arterial
Arterial	9. Divided Principal Arterial	
	10. Divided Principal Arterial with Left Turn Bay	
	12. Divided Principal Arterial with Parking	
	13. One-Way Principal Arterial	
	14. Undivided Principal Arterial	
	15. Undivided Principal Arterial with Left Turn Bay	
	16. Undivided Principal Arterial with Continuous Left Turn	
	17. Divided Minor Arterial	
	18. Divided Minor Arterial with Left Turn Bay	
	20. Divided Minor Arterial with Parking	
	21. One-Way Minor Arterial	
	22. Undivided Minor Arterial	
	23. Undivided Minor Arterial with Left Turn Bay	
	19. Undivided Minor Arterial with Continuous Left Turn	
	32. Undivided Minor Arterial with Parking	
	28. Frontage Road one-way	
	33. Frontage Road two-way	
	24. Divided Collector	Collector
	26. Divided Collector with Left Turn Bay	
	25. Undivided Collector	
	31. Undivided Collector with Continuous Left Turn	
	27. Gravel/Dirt Collector	
	30. Centroid Connector	
	40. Intrazonal	

Hourly and 24-hour Emissions Summaries

By analysis day, individual county and for all counties, the link-emissions estimates were summed for each hour, and the hourly emissions were summed for the day. The resulting composite VOC, CO, and NOx emissions estimates are summarized by individual road type (BPA network functional classification or facility type), individual vehicle type, road type and vehicle type cross classification. VMT, vehicle hours traveled (VHT), VMT-weighted speeds, and other inventory data are included with the emissions summaries. These files (*.LST and a tab delimited version, *.TAB) are provided on CD-ROM (see Appendix A).

APPENDIX A
ELECTRONIC SUBMITTAL DATA SET NAMES AND DESCRIPTIONS

ELECTRONIC SUBMITTAL DATA SET NAMES AND DESCRIPTIONS
This appendix describes the BPA 2000 modeling emissions inventory electronic data submittal.

The BPA 2000 modeling emissions inventories data are contained on three CD-ROMs: 1) a CD-ROM containing the link-emissions files and inventory summary report files, 2) a CD-ROM containing the BPA 1997 travel model network node coordinates, and 3) a CD-ROM with the BPA 2000 MOBILE6 input files (command and external data) and output files (MOBILE6 emissions factors produced with POLFAC6 and RATEADJV6).

The file format for the link emissions files is included (see tables at end of this appendix).

Emissions
The CD-ROM name is BPA00. There is one zip file for each analysis day containing the following 75 files:

- county level hourly link-emissions files (72 ASCII files with .T***hr*** extension);
- IMPSUM6 county-level hourly emissions inventory data summaries to include VMT mix, VMT, VHT, average speed, and emissions cross classified by vehicle type and road type; IMPSUM6 hourly "all counties" emissions inventory data summaries; SUMALL6 county-level and "all counties" 24-hour emissions inventory data summaries (1 ASCII file with .lst extension);
- a tab-delimited version of second bullet above (1 ASCII file with .tab extension); and
- a log of the emissions estimation program runs (1 ASCII file with .log extension).

Zip file names and data set file names follow the convention:

BPA***ddmmm***00.zip
BPA***ddmmm***00.tab
BPA***ddmmm***00.lst
BPA***ddmmm***00.log
countyname_ddmmm00***DDD***_emis.T***hr***

Where:
dd is the day date for each of the analysis days (25, 26, 27, 30);
mmm is the month, AUG or SEP, corresponding to the episode day date (***dd***);
DDD is the day-type (wkd, frd, sat, sun);
countyname is Jefferson, Hardin, Orange; and
hr is 01... 24 representing the hours 12 a.m. through 11 p.m. (local time).

Coordinates
The CD-ROM (XY1997_BPA) has one file, "JOHRTS97coord.txt", that contains longitude and latitude in millionths of degrees for the BPA 1997 network nodes (link endpoints, zone centroids for use with the 2000 link emissions estimates). The order of the data is: network node number, longitude, and latitude.

Emissions Factors
The CD-ROM name is BPA00M6. The MOBILE6 input and output files on the CD-ROM are in the ZIP file named BPA05M6.zip. The emissions factor run input/output files consist of these 43 files:

- MOBILE6 command input files (12):
  ddmmm00_***CNTY***.in.

- MOBILE6 external data input files (5):
  BPA02.rgd (1 regional registration distributions file); and
  BPA_***DD***.vhr (4 hourly VMT files, one per day-type).

- MOBILE6 hourly emissions factor output files (12):
  ddmmm00_***CNTY***.rat.

- MOBILE6 daily emissions factor output files (12)*:
  ddmmm00_***CNTY***.rtd.

- Program run *.LOG and *.LST files (2)**:
  bpaMCR_aug00_RT.LOG; and
  bpaMCR_aug00_RT.LST.

Where:
CNTY is the first four letters of county name for the BPA counties; and
dd is the day date (25, 26, 27, 30); and ***mmm*** is AUG; ***DD*** is day-type (wk, fr, sa, su).

*MOBILE6 Daily Emissions Factors Files:
The set of 24-hour average (i.e., daily or *.rtd) emissions factor files have no impact on the analysis. The "daily all roads" emissions factors (i.e., network composites based on EPA default VMT by facility proportions) in the *.rtd files are invalid. However, the individual MOBILE6 road type (Freeway, Arterial, Local, Ramp) emissions factors are valid.

**Emissions Factor Log (*.LOG) and MOBILE6 Descriptive Output (*.LST) files:
The log files are a record of the emissions factor program (POLFAC62) runs (one file with .log extension). The MOBILE6 descriptive output is a record of the MOBILE6 descriptive output corresponding to each POLFAC62 run/scenario. The value of this output is in the listing of MOBILE6 inputs used; the emissions factors in this MOBILE6 descriptive output, however, are "daily all road types" values which are composed with the MOBILE6 default VMT BY FACILITY values, and thus are not valid.

Link Emissions Data File Format

Abbreviation	Columns	Format Type	Description
A Node	1 - 6	I6	A-Node of link
B Node	7 - 12	I6	B-Node of link
FC	13 - 15	I3	Functional Classification Code of Link (see Facility Type Code table below)
EMISS	17 - 26	A3	“VOC,” or “CO,” or “NOx”
ETYPE	28 - 40	A11	Emissions Sub-Component Type (see Emissions Type Code table below)
LDGV	41 - 50	F10.?*	LDGV link emissions in grams
LDGT1	51 - 60	F10.?	LDGT1 link emissions in grams
LDGT2	61 - 70	F10.?	LDGT2 link emissions in grams
LDGT3	71 - 80	F10.?	LDGT3 link emissions in grams
LDGT4	81 - 90	F10.?	LDGT4 link emissions in grams
HDGV2B	91 - 100	F10.?	HDGV2B link emissions in grams
HDGV3	101 - 110	F10.?	HDGV3 link emissions in grams
HDGV4	111 - 120	F10.?	HDGV4 link emissions in grams
HDGV5	121 - 130	F10.?	HDGV5 link emissions in grams
HDGV6	131 - 140	F10.?	HDGV6 link emissions in grams
HDGV7	141 - 150	F10.?	HDGV7 link emissions in grams
HDGV8A	151 - 160	F10.?	HDGV8A link emissions in grams
HDGV8B	161 - 170	F10.?	HDGV8B link emissions in grams
LDDV	171 - 180	F10.?	LDDV link emissions in grams
LDDT12	181 - 190	F10.?	LDDT12 link emissions in grams
HDDV2B	191 - 200	F10.?	HDDV2B link emissions in grams
HDDV3	201 - 210	F10.?	HDDV3 link emissions in grams
HDDV4	211 - 220	F10.?	HDDV4 link emissions in grams
HDDV5	221 - 230	F10.?	HDDV5 link emissions in grams
HDDV6	231 - 240	F10.?	HDDV6 link emissions in grams
HDDV7	241 - 250	F10.?	HDDV7 link emissions in grams
HDDV8A	251 - 260	F10.?	HDDV8A link emissions in grams
HDDV8B	261 - 270	F10.?	HDDV8B link emissions in grams
MC	271 - 280	F10.?	MC link emissions in grams
HDGB	281 - 290	F10.?	HDGB link emissions in grams
HDDBT	291 - 300	F10.?	HDDBT link emissions in grams
HDDBS	301 - 310	F10.?	HDDBS link emissions in grams
LDDT34	311 - 320	F10.?	LDDT34 link emissions in grams

***** The F10? format is either F10.0, F10.1, F10.2, F10.3, or F10.4. The format selected for a field is based on the value of the field.

Facility Type Codes for BPA Link Emissions

Facility Group	Facility Type (Code and Name)
IH and Freeway	1. Interstate Highway - 10
	2. Freeway - main lanes only
	3. Parkway*
Principle Arterial Divided	9. Divided Principal Arterial
	10. Divided Principal Arterial with Left Turn Bay
	12. Divided Principal Arterial with Parking**
	13. One Way Principal Arterial
Principle Arterial Undivided	14. Undivided Principal Arterial
	15. Undivided Principal Arterial with Left Turn Bay
	16. Undivided Principal Arterial with Continuous Left Turn
Minor Arterial Divided	17. Divided Minor Arterial
	18. Divided Minor Arterial with Left Turn Bay
	20. Divided Minor Arterial with Parking**
	21. One Way Minor Arterial
Minor Arterial Undivided	22. Undivided Minor Arterial
	23. Undivided Minor Arterial with Left Turn Bay
	19. Undivided Minor Arterial with Continuous Left Turn
	32. Undivided Minor Arterial with Parking**
Frontage Road	28. Frontage Road 1-way
	33. Frontage Road 2-way
Ramp	29. Ramp
Collector	24. Divided Collector
	26. Divided Collector with Left Turn Bay
	25. Undivided Collector
	31. Undivided Collector with Continuous Left Turn
	27. Gravel/Dirt Collector
Local	30. Centroid Connector
	40. Intrazonal

* Parkway is a Freeway without any supporting Frontage Roads.

** Denotes allowable parking which obstructs a normal traffic flow lane.

Emissions Sub-Component Type

Sub-Component Abbreviation	Comments
COMPOSITE	Total emissions
EXH_RUNNING	Exhaust running emissions
START	Start emissions
Hot_Soak	Hot Soak VOC emissions
Diurnal	Diurnal VOC emissions
Rest_Loss	Resting loss VOC emissions
Run_Loss	Running loss VOC emissions
Crankcase	Crankcase VOC emissions
Refueling	Refueling loss VOC emissions

APPENDIX B
EMISSIONS ESTIMATION PROGRAMS

TTI EMISSIONS ESTIMATION PROGRAMS

The following is a summary of the series of programs developed by TTI for developing link-based, time-of-day, on-road mobile source emissions estimates for air quality analyses.

These programs produce emissions factors with the latest version of EPA's MOBILE emissions factor model, and apply them to travel model-based activity estimates to calculate emissions at user-specified temporal and spatial scales. The location of emissions by grid, or travel network link coordinates, may also be specified.

The emissions estimation programs are: PREPIN2BW, POLFAC62, RATEADJ62, RATEADJV62, IMPSUM62, and SUMALL62. PREPIN2BW prepares activity input, POLFAC62 prepares emissions factor input, the RATEADJ programs make special adjustments to emissions factors when required, IMPSUM62 calculates emissions by time period, and SUMALL62 summarizes emissions at various levels by 24-hour period.

PREPIN2BW

The PREPIN2BW program post-processes travel model output to produce time-of-day-specific, on-road vehicle fleet, link VMT and speed estimates for emissions inventory applications. The PREPIN2BW program was developed for use in urban areas that do not have all of the time-of-day assignments and operational speeds available as may be required for air quality analyses of particular temporal scales (e.g., hourly). For example, PREPIN2BW reads a travel demand model traffic assignment data set from a directional four period time-of-day assignment (another common assignment read by PREPIN2BW is the nondirectional or directional 24-hour assignment). PREPIN2BW initially scales the assignment volumes on each link to the appropriate VMT (seasonal, day-of-week specific, for instance). Time-of-day (hourly, for example) factors (and directional split factors, in the case of a nondirectional assignment) are applied to the adjusted assignment results on each link to estimate the directional time-of-day travel on the link. Speed models, originally developed for the Dallas/Fort Worth Region or optionally the Houston/Galveston Region, are used to estimate the operational time-of-day speeds by direction on the links. Special intrazonal links are defined (as intrazonal links are not a feature of travel demand models), and the VMT and speeds for intrazonal trips are estimated. These VMT and speeds by link are subsequently input to the IMPSUM62 program for the application of MOBILE6 emissions factors.

POLFAC62

The POLFAC62 program is used to apply the EPA's MOBILE6 program (October 2002 version with additional pollutant capabilities) to calculate the on-road mobile emissions factors. The MOBILE6 emissions factors may be produced for each of the pollutant-specific emissions types (e.g., depending on the pollutant and vehicle type, the total composite, exhaust running, exhaust start, plus the six sub-component evaporative rates), 28 vehicle types, four MOBILE6 functional classifications (or drive cycles, i.e., Freeway, Arterial/Collector, Local, and Ramp), 14 speeds (i.e., 2.5 mph, and 5 mph through 65 mph at 5 mph increments for Freeway and Arterial functional classifications—MOBILE6 local and ramp functional classification rates are single speed only, 12.9 mph, and 34.6 mph, respectively), and each of the 24 hours of the day. The POLFAC62 emissions factors are average vehicle class rates calculated from the MOBILE6

database output by weighting the by-model-year emissions rates within each vehicle class by its corresponding travel fraction. These emissions factors are tabulated individually by geographical area (county or county group) and analysis day for the evaluation year. These emissions factors are output to an ASCII file for subsequent input to the IMPSUM62 program. The IMPSUM62 program is then used to apply the hourly emissions factors to hourly VMT estimates by link. (POLFAC62 also optionally produces a set of daily emissions factors.) POLFAC62 also calculates the additional pollutant emissions factors provided by the MOBILE6 October 2002 verstion.

RATEADJ62
RATEADJ62 is a special utility program that produces a new set of emissions factors by linearly combining the emissions factors from multiple applications of POLFAC62. There is one set of linear factors. Each factor is applied to all emissions rates in a single data set.

A practical application of the RATEADJ program is the combining of two sets of emissions factors, where each set has different control program credits, into one set including the combined credits. For example, this program may be used to combine different Anti-Tampering Program (ATP) credits from two separate POLFAC62 runs into one set of emissions factors that includes the credits for both ATPs.

RATEADJV62
RATEADJV62 is a special utility program that produces a new set of emissions factors by linearly combining the emissions factors from multiple applications of POLFAC62 or RATEADJ62. There is a separate set of factors (that may be different for each pollutant-specific emissions type and vehicle type combination) for each of the input emissions factor data sets.

A practical application of RATEADJV62 is the application of emissions factor credits by individual vehicle class and/or individual pollutant. For example, for analyses requiring the effects of the Texas Low Emissions Diesel Fuel Program in MOBILE6 emissions factors, RATEADJV62 is used to apply reduction factors to only the NOx emissions factors for diesel-fueled vehicle classes only.

IMPSUM62
The IMPSUM62 program applies the emissions factors obtained from POLFAC62 (or from one of the RATEADJ programs, when used) and VMT mixes (fractions of fleet VMT attributable to each vehicle classification in the study) to the time-of-day fleet VMT and speed estimates to calculate emissions by the specified time periods. The five primary inputs to IMPSUM62 are:

- MOBILE6 emissions factors developed with POLFAC62 (or a RATEADJ6, if used);
- link-based hourly VMT and speeds developed using a PREPIN2BW program. For each link, the following information is input to IMPSUM: county number, roadway type number, VMT on link, operational link-speed estimate, and link distance;
- VMT mix by time period, county and roadway type;

- X-Y coordinates (optional for gridded emissions); and

- data records associating the MOBILE6 drive cycle (Freeway, Arterial, Local, Ramp) emissions factors (or percentages thereof) to specific travel model functional classifications. These MOBILE6 drive cycle emissions factor percentages (valid from zero to 100) must sum to 100 percent for each travel model functional classification.

Using these input data, the VMT for each link is stratified by MOBILE6 drive cycle and the 28 vehicle types. The MOBILE6 emissions factors are matched to link VMT by drive cycle, speed, and vehicle type and are interpolated (for the speed that falls between the 14 MOBILE6 speeds, see the MOBILE6 interpolation methodology below) and multiplied by the link VMT to estimate the mobile source emissions for that link. Emissions factors for 65 mph are used for links with speeds greater than 65 mph and emissions factors for 2.5 mph are used for links with speeds lower than 2.5 mph. The emissions for the county and emissions type are reported by both roadway type and vehicle type for each of the subject time periods. A data set is produced for subsequent input to the SUMALL62 program. Also, link emissions may be written by county at the pollutant-specific emissions type sub-component level and 28 vehicle types level.

A tab-delimited output is optionally produced. This output includes all 28 vehicle types (or eight vehicle types in the compressed format) across a single output line. Each field in the output is separated by a tab character.

Example Emissions Factor Interpolation
To calculate emissions factors for average operational speeds that fall between two of the 14 MOBILE6 speed bin speeds, MOBILE6 interpolates each emissions factor using a factor developed from the inverse link speed and the inverse high and low bounding speed bin speeds (Section 5.3.4, MOBILE6 User's Guide, January 2002).

Using the MOBILE6 emissions factors tabulated by the 14 speeds, the IMPSUM62 program uses the MOBILE6 method to interpolate emissions factors as shown in the following example. This example interpolates an emissions factor corresponding to an average speed of 41.2 mph.

The interpolated emissions factor (EF_{Interp}) is expressed as:

$$EF_{Interp} = EF_{LowSpeed} - FAC_{Interp} \times (EF_{LowSpeed} - EF_{HighSpeed})$$

Where:

$EF_{LowSpeed}$ = emission factor (EF) corresponding to tabulated speed below the average link speed,

$EF_{HighSpeed}$ = EF corresponding to tabulated speed above the average link speed, and

$$FAC_{Interp} = \left(\frac{1}{Speed_{link}} - \frac{1}{Speed_{low}}\right) \Big/ \left(\frac{1}{Speed_{high}} - \frac{1}{Speed_{low}}\right)$$

Given that:

$EF_{LowSpeed}$ = 0.7413 g/mi,
$EF_{HighSpeed}$ = 0.7274 g/mi,
$Speed_{lnk}$ = 41.2 mph,
$Speed_{low}$ = 40 mph, and
$Speed_{high}$ = 45 mph.

$$FAC_{Interp} = \left(\frac{1}{41.2mph} - \frac{1}{40mph}\right) \Big/ \left(\frac{1}{45mph} - \frac{1}{40mph}\right) = \frac{-0.00073}{-0.00278} = 0.26214,$$

EF_{Interp} = 0.7413 g/mi - (0.26214) × (0.7413 g/mi - 0.7274 g/mi)

= 0.7377 g/mi

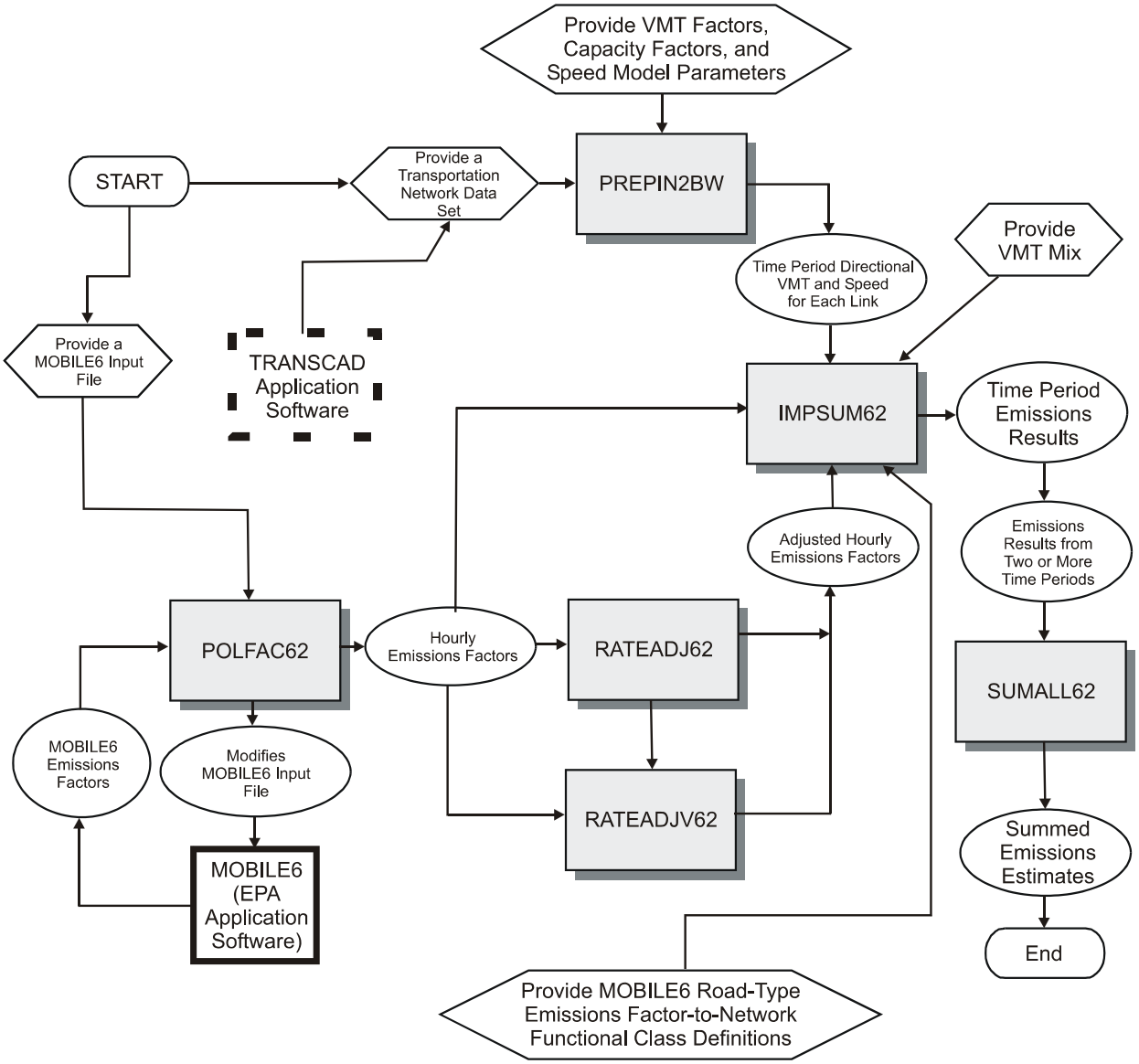
SUMALL62
The SUMALL62 program is used to sum the emissions estimates for the time-of-day periods (e.g., 24 periods in the case of hourly analyses) to develop 24-hour emissions estimates. The emissions by pollutant type are reported by roadway type and 28 vehicle types (or optionally condensed to eight vehicle types).

A tab-delimited output is optionally produced. This output includes all 28 vehicle types (or eight vehicle types in the compressed format) across a single output line. Each field in the output is separated by a tab character.

The overall emissions estimate process flow is shown in the diagram below.

General Process Flow

Travel Demand Model Network Link-Based Hourly MOBILE6 Emissions Estimates with Texas Mobile Source Emissions Software



APPENDIX C
DIRECTIONAL SPLIT ESTIMATES

AM Peak-Period Directional Split Estimates

Area Types**	Functional Classifications*								
	0	1	3	4	5	6	7	8	9
	Centroid Connector	IH and Freeway	Principle Arterial Divided	Principle Arterial Undivided	Minor Arterial Divided	Minor Arterial Undivided	Collector	Frontage Road	Ramp
1 CBD	54.0	50.0	65.0	65.0	58.0	58.0	64.5	50.0	50.0
2 CBD Fringe	87.0	50.0	60.0	60.0	59.0	59.0	63.0	50.0	50.0
3 Urban	85.0	60.0	62.0	62.0	58.0	58.0	53.0	60.0	60.0
4 Suburban	72.0	61.0	65.0	65.0	64.0	64.0	64.5	61.0	61.0
5 Suburban Fringe	80.0	65.0	68.0	68.0	66.0	66.0	62.5	67.0	67.0
6 Rural	78.0	70.0	71.0	71.0	68.0	68.0	75.0	70.0	70.0

* The 1997 BPA TDM network traffic assignment are based on facility type. The functional classification-to-facility type correlation is shown in the last table of this appendix.

Mid-Day and Overnight (Off-Peak) Directional Split Estimates

Area Types**	Functional Classifications*								
	0	1	3	4	5	6	7	8	9
	Centroid Connector	IH and Freeway	Principle Arterial Divided	Principle Arterial Undivided	Minor Arterial Divided	Minor Arterial Undivided	Collector	Frontage Road	Ramp
1 CBD	54.0	51.0	55.0	55.0	55.0	55.0	54.5	51.0	51.0
2 CBD Fringe	54.0	51.0	54.0	54.0	55.0	55.0	53.0	51.0	51.0
3 Urban	55.0	53.0	50.0	50.0	52.0	52.0	52.0	53.0	53.0
4 Suburban	55.0	51.0	57.0	57.0	56.0	56.0	57.0	51.0	51.0
5 Suburban Fringe	53.0	51.0	56.0	56.0	57.0	57.0	54.0	51.0	51.0
6 Rural	52.0	53.0	55.0	55.0	58.0	58.0	54.0	53.0	53.0

* The 1997 BPA TDM network traffic assignment are based on facility type. The functional classification-to-facility type correlation is shown in the last table of this appendix.

PM Peak-Period Directional Split Estimates

Area Types**	Functional Classifications*								
	0	1	3	4	5	6	7	8	9
	Centroid Connector	IH and Freeway	Principle Arterial Divided	Principle Arterial Undivided	Minor Arterial Divided	Minor Arterial Undivided	Collector	Frontage Road	Ramp
1 CBD	55.0	54.0	62.0	62.0	52.0	52.0	57.5	54.0	54.0
2 CBD Fringe	72.0	54.0	59.0	59.0	53.0	53.0	64.5	54.0	54.0
3 Urban	72.0	56.0	57.0	57.0	64.0	64.0	68.0	56.0	56.0
4 Suburban	72.0	67.0	60.0	60.0	65.0	65.0	62.5	67.0	67.0
5 Suburban Fringe	71.0	66.0	63.0	63.0	64.0	64.0	67.0	66.0	66.0
6 Rural	71.0	65.0	66.0	66.0	63.0	63.0	70.0	65.0	65.0

* The 1997 BPA TDM network traffic assignment are based on facility type. The functional classification-to-facility type correlation is shown in the last table of this appendix.

BPA Network Facility Types Correlated to Functional Classifications

Functional Classification	Facility Type
IH and Freeway	1. Interstate Highway - 10
	2. Freeway - main lanes only
	3. Parkway
Principle Arterial Divided	9. Divided Principal Arterial
	10. Divided Principal Arterial with Left Turn Bay
	12. Divided Principal Arterial with Parking*
	13. One-Way Principal Arterial
Principle Arterial Undivided	14. Undivided Principal Arterial
	15. Undivided Principal Arterial with Left Turn Bay
	16. Undivided Principal Arterial with Continuous Left Turn
Minor Arterial Divided	17. Divided Minor Arterial
	18. Divided Minor Arterial with Left Turn Bay
	20. Divided Minor Arterial with Parking*
	21. One-Way Minor Arterial
Minor Arterial Undivided	22. Undivided Minor Arterial
	23. Undivided Minor Arterial with Left Turn Bay
	19. Undivided Minor Arterial with Continuous Left Turn
	32. Undivided Minor Arterial with Parking*
Frontage Road	28. Frontage Road One-Way
	33. Frontage Road Two-Way
Ramp	29. Ramp
Collector	24. Divided Collector
	26. Divided Collector with Left Turn Bay
	25. Undivided Collector
	31. Undivided Collector with Continuous Left Turn
	27. Gravel/Dirt Collector
Centroid Connector	0. Centroid Connector
Intrazonal	40. Intrazonal

* Allowable parking that obstructs a normal traffic flow lane.

APPENDIX D
CAPACITY FACTORS AND SPEED FACTORS

BPA 1997 TDM Capacity Factors

Facility Type*	Regional Area Type					
	CBD	CBD Fringe	Urban	Suburban	Suburban Fringe	Rural
1	0.1034	0.1063	0.0942	0.1185	0.1330	0.1905
2	0.1034	0.1063	0.0942	0.1185	0.1330	0.1905
3	0.1034	0.1063	0.0942	0.1185	0.1330	0.1905
9	0.0724	0.0811	0.0903	0.1043	0.1351	0.1416
10	0.0724	0.0811	0.0903	0.1043	0.1351	0.1416
13	0.0724	0.0811	0.0903	0.1043	0.1119	0.1231
14	0.0685	0.0775	0.0870	0.1007	0.1077	0.1151
15	0.0685	0.0775	0.0870	0.1007	0.1077	0.1151
16	0.0685	0.0775	0.0870	0.1007	0.1077	0.1151
17	0.0809	0.0902	0.0969	0.1261	0.1543	0.1667
18	0.0809	0.0902	0.0969	0.1261	0.1543	0.1667
19	0.0769	0.0873	0.0943	0.1059	0.1140	0.1227
20	0.0809	0.0902	0.0969	0.1261	0.1543	0.1667
21	0.0809	0.0902	0.0969	0.1261	0.1543	0.1667
22	0.0769	0.0873	0.0943	0.1059	0.1140	0.1227
23	0.0769	0.0873	0.0943	0.1059	0.1140	0.1227
24	0.0750	0.0848	0.0962	0.1146	0.1280	0.1438
25	0.0727	0.0833	0.0978	0.1190	0.1350	0.1544
26	0.0750	0.0848	0.0962	0.1146	0.1280	0.1438
27	0.0727	0.0833	0.0978	0.1190	0.1350	0.1544
28	0.0482	0.0541	0.0579	0.0667	0.0721	0.0769
29	0.0726	0.0811	0.0865	0.1007	0.1306	0.1327
30	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000
31	0.0727	0.0833	0.0978	0.1190	0.1350	0.1544
32	0.0769	0.0873	0.0943	0.1059	0.1140	0.1227
33	0.0719	0.0815	0.0871	0.0984	0.1287	0.1324

* See facility type name/number key at end of appendix.

BPA 1997 TDM Freeflow (Volume = 1) Speed Factors

Facility Type*	Area Type												
	CBD	CBD	Urban	Suburban	Suburban	Rural	Urban	Suburban	Suburban	Rural	Suburban	Suburban	Rural
1	1.3333	1.2609	1.5128	1.3636	1.4773	1.2679	2.0345	1.4634	1.5854	1.5435	1.3333	1.3333	1.6905
2	1.3333	1.2609	1.5128	1.2766	1.4773	1.2241	1.3333	1.3333	1.3333	1.3333	1.4286	1.3333	1.6905
3	1.3333	1.3333	1.5128	1.3636	1.3333	1.2679	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333
9	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333
10	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333
12	--	--	--	--	--	--	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333
13	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333
14	--	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333
15	--	1.3333	1.3333	--	--	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333
16	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333
17	1.3333	--	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333
18	1.3333	--	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333
19	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333
20	--	--	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333
21	1.3333	1.3333	1.3333	1.3333	--	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333
22	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333
23	1.3333	1.3333	1.3333	--	--	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333

BPA 1997 TDM Freeflow (Volume = 1) Speed Factors (continued)

Facility Type	Area Type												
	CBD Jefferson	CBD Fringe Jefferson	Urban Jefferson	Suburban Jefferson	Suburban Fringe Jefferson	Rural Jefferson	Urban Orange	Suburban Orange	Suburban Fringe Orange	Rural Orange	Suburban Hardin	Suburban Fringe Hardin	Rural Hardin
24	1.3333	--	1.3333	1.3333	--	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333
25	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333
26	1.3333	1.3333	1.3333	--	--	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333
27	1.3333	--	--	--	--	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	---	1.3333
28	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333
29	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333
31	1.3333	1.3333	1.3333	1.3333	--	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333
32	--	--	--	--	--	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333	1.3333
33	--	--	--	1.3333	1.3333	1.3333	--	--	1.3333	1.3333	1.3333		1.3333

* See facility type name/number key at end of appendix.

Facility Type Number Key

Facility Type Number	Facility Description
1	Interstate Highway - 10
2	Freeway - main lanes only
3	Parkway
9	Divided Principal Arterial
10	Divided Principal Arterial with Left Turn Bay
12	Divided Principal Arterial with Parking
13	One-Way Principal Arterial
14	Undivided Principal Arterial
15	Undivided Principal Arterial with Left Turn Bay
16	Undivided Principal Arterial with Continuous Left Turn
17	Divided Minor Arterial
18	Divided Minor Arterial with Left Turn Bay
19	Undivided Minor Arterial with Continuous Left Turn
20	Divided Minor Arterial with Parking
21	One-Way Minor Arterial
22	Undivided Minor Arterial
23	Undivided Minor Arterial with Left Turn Bay
24	Divided Collector
25	Undivided Collector
26	Divided Collector with Left Turn Bay
27	Gravel/Dirt Collector
28	Frontage Road One-Way
29	Ramp
31	Undivided Collector with Continuous Left Turn
32	Undivided Minor Arterial with Parking
33	Frontage Road Two-Way

APPENDIX E
BPA AUGUST 2000 EPISODE DAY CLIMATIC INPUTS TO MOBILE6

BPA COUNTY AUGUST 2000 EPISODE DAY CLIMATIC INPUTS TO MOBILE6

Hourly temperatures (degrees F)**,**
Hour of sunrise and sunset,
Hourly relative humidity (percent), and
Barometric pressure (inches of Mercury).

Central Daylight (Local) Time (hourly data sequence: 6 a.m. to 12 a.m., 12 a.m. to 6 a.m.).

* Climate data for Hardin County: Friday August 25, 2000 (CDT)
HOURLY TEMPERATURES: 73.9 74.3 76.1 78.7 80.7 82.9 85.6 89.6 91.2 92.0 92.4 91.2 88.8 86.3 83.8 82.0 80.8 79.4 75.9 75.4 75.1 74.6 74.2 73.5
SUNRISE/SUNSET: 7 8
RELATIVE HUMIDITY: 96.0 85.0 82.0 72.0 65.0 56.0 52.0 44.0 41.0 58.0 62.0 65.0 77.0 85.0 94.0 97.0 97.0 97.0 100.0 100.0 96.0 100.0 100.0 100.0
BAROMETRIC PRES: 29.93

* Climate data for Jefferson County: Friday August 25, 2000 (CDT)
HOURLY TEMPERATURES: 74.5 75.7 78.8 81.8 83.3 85.4 87.8 90.0 91.4 91.6 90.9 89.4 87.2 84.4 81.3 79.8 78.9 78.0 75.1 74.6 74.7 74.4 74.0 73.9
SUNRISE/SUNSET: 7 8
RELATIVE HUMIDITY: 96.0 85.0 82.0 72.0 65.0 56.0 52.0 44.0 41.0 58.0 62.0 65.0 77.0 85.0 94.0 97.0 97.0 97.0 100.0 100.0 96.0 100.0 100.0 100.0
BAROMETRIC PRES: 29.93

* Climate data for Orange County: Friday August 25, 2000 (CDT)
HOURLY TEMPERATURES: 73.4 74.1 75.4 78.3 82.2 85.0 88.2 90.5 91.1 91.9 92.4 91.4 89.4 86.1 82.5 80.5 79.5 77.5 74.3 73.8 75.1 74.5 73.8 73.4
SUNRISE/SUNSET: 7 8
RELATIVE HUMIDITY: 96.0 85.0 82.0 72.0 65.0 56.0 52.0 44.0 41.0 58.0 62.0 65.0 77.0 85.0 94.0 97.0 97.0 97.0 100.0 100.0 96.0 100.0 100.0 100.0
BAROMETRIC PRES: 29.93

* Climate data for Hardin County: Saturday August 26, 2000 (CDT)
HOURLY TEMPERATURES: 76.4 76.2 77.7 80.0 83.4 86.2 89.3 91.0 92.9 92.6 93.4 92.3 90.1 86.7 83.8 82.0 80.8 79.7 78.7 78.0 77.5 77.2 77.1 76.7
SUNRISE/SUNSET: 7 8
RELATIVE HUMIDITY: 97.0 88.0 75.0 67.0 59.0 57.0 54.0 53.0 51.0 50.0 52.0 61.0 77.0 87.0 87.0 94.0 94.0 100.0 100.0 100.0 96.0 100.0 100.0 100.0
BAROMETRIC PRES: 29.86

* Climate data for Jefferson County: Saturday August 26, 2000 (CDT)
HOURLY TEMPERATURES: 74.8 76.1 79.3 82.2 84.8 87.2 89.3 91.2 92.0 92.4 92.0 90.5 87.9 84.4
81.6 79.8 78.9 78.0 77.1 76.3 75.7 75.0 74.4 74.5
SUNRISE/SUNSET: 7 8
RELATIVE HUMIDITY: 97.0 88.0 75.0 67.0 59.0 57.0 54.0 53.0 51.0 50.0 52.0 61.0
77.0 87.0 87.0 94.0 94.0 100.0 100.0 100.0 96.0 100.0 100.0 100.0
BAROMETRIC PRES: 29.86

* Climate data for Orange County: Saturday August 26, 2000 (CDT)
HOURLY TEMPERATURES: 72.9 73.9 77.0 81.4 84.4 86.8 89.3 91.2 92.6 93.4 93.5 92.4 90.0 86.1
82.5 80.2 79.0 77.3 76.3 75.5 75.0 74.3 73.6 73.0
SUNRISE/SUNSET: 7 8
RELATIVE HUMIDITY: 97.0 88.0 75.0 67.0 59.0 57.0 54.0 53.0 51.0 50.0 52.0 61.0
77.0 87.0 87.0 94.0 94.0 100.0 100.0 100.0 96.0 100.0 100.0 100.0
BAROMETRIC PRES: 29.86

* Climate data for Hardin County: Sunday August 27, 2000 (CDT)
HOURLY TEMPERATURES: 77.4 77.6 80.5 83.9 86.2 88.8 90.7 92.8 93.9 94.3 93.1 91.5 89.4 86.5
84.6 83.6 82.6 81.4 79.6 80.3 79.6 78.5 77.5 77.1
SUNRISE/SUNSET: 7 8
RELATIVE HUMIDITY: 96.0 79.0 70.0 59.0 56.0 54.0 47.0 46.0 51.0 54.0 59.0 70.0
77.0 87.0 90.0 93.0 97.0 94.0 96.0 97.0 97.0 100.0 100.0 100.0
BAROMETRIC PRES: 29.83

* Climate data for Jefferson County: Sunday August 27, 2000 (CDT)
HOURLY TEMPERATURES: 75.9 77.0 81.7 85.6 87.9 90.0 91.4 92.7 92.9 92.6 91.4 89.8 87.6 84.8
82.4 81.4 80.4 79.6 77.7 77.7 77.2 76.6 76.3 75.6
SUNRISE/SUNSET: 7 8
RELATIVE HUMIDITY: 96.0 79.0 70.0 59.0 56.0 54.0 47.0 46.0 51.0 54.0 59.0 70.0
77.0 87.0 90.0 93.0 97.0 94.0 96.0 97.0 97.0 100.0 100.0 100.0
BAROMETRIC PRES: 29.83

* Climate data for Orange County: Sunday August 27, 2000 (CDT)
HOURLY TEMPERATURES: 72.9 73.7 77.5 82.2 86.0 88.9 91.0 92.6 93.3 93.5 92.8 91.4 89.2 85.9
83.0 81.0 79.3 78.4 77.1 76.5 75.2 74.8 73.6 72.8
SUNRISE/SUNSET: 7 8
RELATIVE HUMIDITY: 96.0 79.0 70.0 59.0 56.0 54.0 47.0 46.0 51.0 54.0 59.0 70.0
77.0 87.0 90.0 93.0 97.0 94.0 96.0 97.0 97.0 100.0 100.0 100.0
BAROMETRIC PRES: 29.83

* Climate data for Hardin County: Wednesday August 30, 2000 (CDT)
HOURLY TEMPERATURES: 77.5 77.6 79.5 82.7 86.3 89.8 92.9 95.7 98.1 100.0 101.4 101.8 101.5
96.5 90.9 87.4 85.6 84.2 80.0 79.9 78.5 78.8 78.2 77.5
SUNRISE/SUNSET: 7 8
RELATIVE HUMIDITY: 94.0 82.0 72.0 61.0 56.0 48.0 43.0 37.0 36.0 48.0 58.0 65.0
77.0 85.0 85.0 87.0 90.0 90.0 96.0 100.0 97.0 97.0 97.0 100.0
BAROMETRIC PRES: 29.87

* Climate data for Jefferson County: Wednesday August 30, 2000 (CDT)
HOURLY TEMPERATURES: 75.8 76.6 79.7 83.7 87.9 91.5 95.0 97.4 99.4 100.5 100.6 99.7 96.6
91.3 87.0 84.6 83.3 82.2 78.5 78.1 77.7 77.0 76.1 75.7
SUNRISE/SUNSET: 7 8
RELATIVE HUMIDITY: 94.0 82.0 72.0 61.0 56.0 48.0 43.0 37.0 36.0 48.0 58.0 65.0
77.0 85.0 85.0 87.0 90.0 90.0 96.0 100.0 97.0 97.0 97.0 100.0
BAROMETRIC PRES: 29.87

* Climate data for Orange County: Wednesday August 30, 2000 (CDT)
HOURLY TEMPERATURES: 74.8 75.5 78.2 82.7 87.6 91.5 95.3 98.2 100.5 101.8 102.3 101.3 99.1
93.2 89.7 86.9 84.6 82.5 78.6 77.1 76.6 76.4 75.5 75.6
SUNRISE/SUNSET: 7 8
RELATIVE HUMIDITY: 94.0 82.0 72.0 61.0 56.0 48.0 43.0 37.0 36.0 48.0 58.0 65.0
77.0 85.0 85.0 87.0 90.0 90.0 96.0 100.0 97.0 97.0 97.0 100.0
BAROMETRIC PRES: 29.87